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NATIONAL DAM SAFETY PROGRAM. MCDANIEL DAM (MO 20038), MISSOURI --ETC(U)
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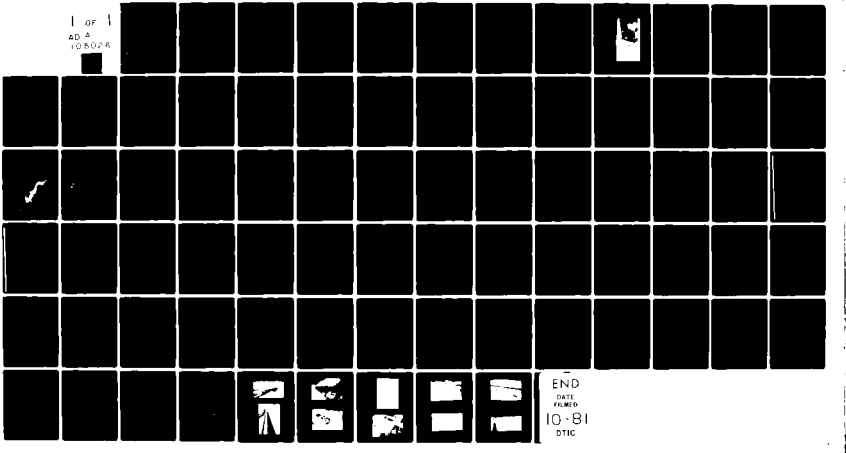

LEVEL II

MISSOURI - OSAGE - GASCONADE BASIN

McDANIEL LAKE DAM

GREENE COUNTY, MISSOURI

MO 20038

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
Corps of Engineers
... Serving the Army
... Serving the Nation

St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

SEPTEMBER 1979

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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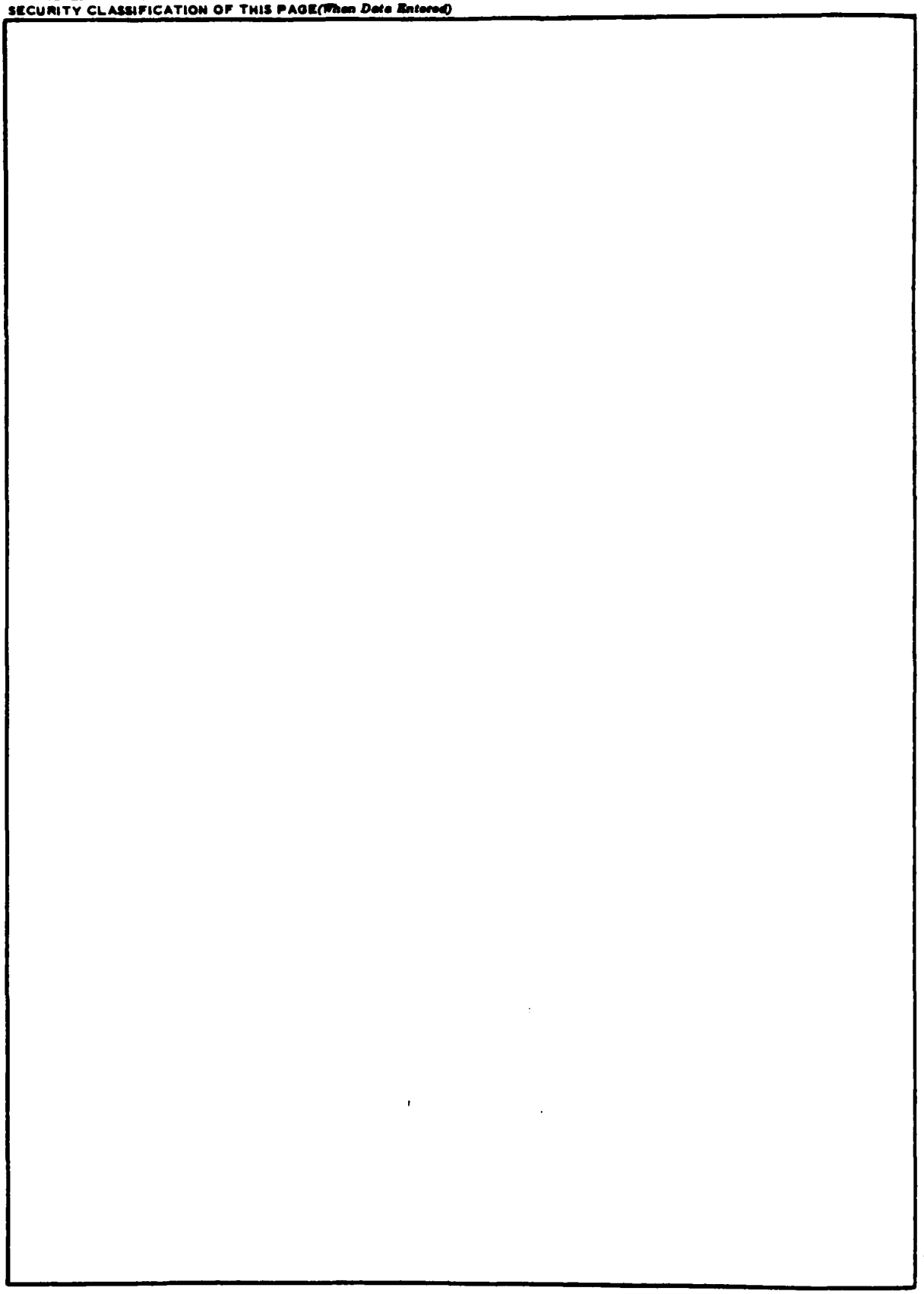

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: McDaniel Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the McDaniel Lake Dam (MO 20038):

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood.
2) Overtopping could result in dam failure.
3) Dam failure significantly increases the hazard to loss of life downstream.

This classification is based on the fact that the spillway flashboards can be successfully removed prior to large stream flows. An operation plan should be developed and put in effect for successful removal of flashboards during large stream flows.

In the event the flashboards cannot or are not removed, the spillway is not capable of passing a 10-year storm without overtopping the dam and thus is classified as unsafe, emergency.

It is strongly recommended that the flashboard removal plan be developed and implemented immediately.

SUBMITTED BY: SIGNED
Chief, Engineering Division — 29 FEB 1980
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer — 29 FEB 1980
Date

McDANIEL LAKE DAM

GREENE COUNTY, MISSOURI

MISSOURI INVENTORY NO. 20038

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY

L. ROBERT KIMBALL AND ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS
EBENSBURG, PENNSYLVANIA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

SEPTEMBER 1979

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM	McDaniel Lake Dam
STATE LOCATED	Missouri
COUNTY LOCATED	Greene
STREAM	Little Sack River
DATE OF INSPECTION	June 6 and 7, 1979

McDaniel Lake Dam was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of federal and state sgencies, professional engineering organizations and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property damage could occur in the event of failure of the dam. The dam is in the intermediate size classification since the storage is greater than 1000 acre-feet but less than 50,000 acre-feet. The Spillway Design Flood is the PMF (Probable Maximum Flood). The downstream affected areas include State Road 13, located 1/2 mile downstream of the dam and approximately six dwellings located within the estimated damage zone of 6 miles downstream of the dam.

The dam is capable of controlling less than 10% of the PMF without overtopping the dam under the conditions observed during the inspection. In addition, the dam cannot control the 10-year storm.

Deficiencies visually observed were hairline cracking in the downstream slope of the concrete dam, deterioration of the concrete in the construction joints of the downstream slope, sedimentation and vegetation upstream of the emergency spillway, vegetation in the spillway exit channel and possible inoperability of the drain line valve. In addition, the lack of stability, stress and seepage analyses and a warning system is also a deficiency according to the "Recommended Guidelines for Safety Inspection of Dams", which should be corrected at the direction of a professional engineer knowledgeable in concrete dam design.

It is recommended that the owner take prompt action to correct or control the deficiencies described.

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Geologist

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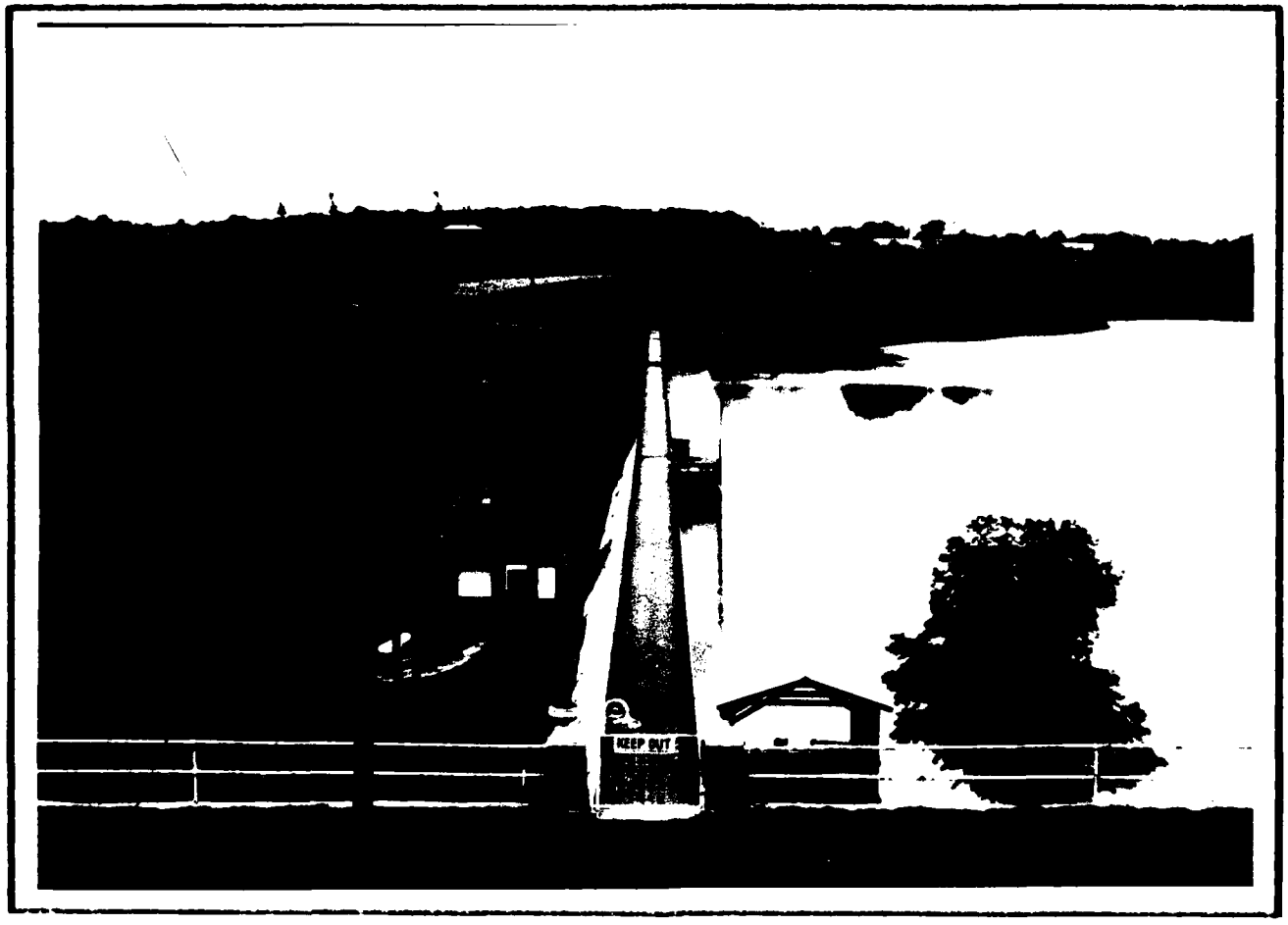

Memorial Lake Dam - Overview

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
McDANIEL LAKE DAM - ID NO. 20038

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, The St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the McDaniel Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based on available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam was furnished by the Department of the army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) McDaniel Lake Dam consists of a concrete gravity wall 712 feet long and 51 feet high. The upstream slope of the dam is vertical and the downstream slope is vertical above elevation 1120.0 and 0.6H:1V below elevation 1120.0. The top width is 6.5 feet and serves as a walkway. An earth berm acts as a buttress on the downstream slope of the dam. The top of the earth berm is elevation 1103.0.

The spillway is located on the right abutment and is cut in the limestone bedrock. The spillway has a 7 to 8 foot high concrete ogee sill with 21 bays, each 19.4 feet in length. Seventeen of the spillway bays are equipped with permanent flashboards. Four of the bays have trippable flashboards. The spillway exit channel has concrete reinforced sidewalls with a natural limestone bedrock bottom.

Water is drawn off the reservoir through three 30" diameter intakes located at different levels. The water enters the pump house which is located on the earthen berm about midway between the abutments and immediately downstream of the dam. Water is pumped to the treatment plant through a 24" or a 30" diameter pipe.

Fellows Lake Dam is located upstream of Lake McDaniel. The dam is a rolled earth embankment 500 feet long, 100 feet high and creates a lake of 28,000 acre-feet.

b. Location. McDaniel Lake Dam is located approximately 3 miles north of the intersection of Interstate 44 and State Highway 13 near Springfield, Greene County, Missouri on the Little Sack River. The dam can be located (Section 26, Township 30 North, Range 22 West) on the Ebenezer, Missouri 7.5 minute U.S.G.S Quadrangle.

c. Size Classification. McDaniel Lake Dam is an intermediate size dam (51 feet high, 5062 acre-feet).

d. Hazard Classification. McDaniel Lake Dam is a high hazard dam. Downstream conditions indicate that loss of life is probable should failure of the dam occur.

e. Ownership. McDaniel Lake Dam is owned by Springfield City Utilities. Correspondence should be addressed to:

Mr. David Plank
Springfield City Utilities
301 East Central Street
Jewell P.O. Box 551
Springfield, MO 65801
417-831-8520

f. Purpose of Dam. McDaniel Lake Dam is used for water supply.

g. Design and Construction History. The dam was designed by Phillip Ebenezer, Consulting Engineer. The dam was built by the Burnip Construction Company and completed in 1929. No design reports or construction history exist. The construction drawings were available for review at the city's office.

h. Normal Operating Procedures. Normal operating procedure is to maintain the normal pool of McDaniel Lake at or just below spillway crest. To maintain this high lake level, water is stored in Fellows Lake (upstream of McDaniel Lake) and discharged into McDaniel Lake through a drain tunnel. In addition, approximately five wells are drilled around the McDaniel Lake which discharge approximately 2.5 million gallons a day into McDaniel Lake. Daily water consumption approximates 17.5 million gallons per day with a peak of 25 million gallons per day. A resident caretaker lives at the dam to perform operations and maintenance. Water levels are telemetered to the Fulbright Treatment Plant, but data was not available for review.

1.3 PERTINENT DATA

a. Drainage Area-total 39.1 square miles
-direct contributing 18.9 square miles

b. Discharge at Dam Site (cfs).

(1)	Maximum known flood at dam site	Unknown
(2)	Spillway capacity (existing conditions with flashboards)	9,664
(3)	Spillway capacity with flashboards removed	18,296
(4)	Drainlines	Unknown

c. Elevation (feet) - Based on spillway crest elevation shown on U.S.G.S quadrangle.

(1)	Top of dam (Maximum Pool)	1128.7
(2)	Spillway crest (top of concrete sill)	1123.0
(3)	Normal pool	1123.0
(4)	High pool elevation - PMF	1136.7
(5)	Entrance inverts on drain line	Unknown
(6)	Tailwater on day of inspection	None
(7)	Streambed at centerline of dam	1077.0

d. Reservoir (feet).

(1)	Length of maximum pool	19,000
(2)	Length of normal pool	12,000

e. Storage (acre-feet).

(1)	Top of dam	5,062
(2)	Spillway crest	3,541
(3)	Normal pool	3,541
(4)	Maximum pool (PMF)	7,865

f. Reservoir surface (acres).

(1)	Top of dam	305
(2)	Spillway crest	226
(3)	Normal pool	226
(4)	Maximum pool (PMF)	380

g. Dam.

(1)	Type	Concrete gravity with earth buttress
(2)	Length	712 feet
(3)	Height	51 feet
(4)	Top width	6.5 feet
(5)	Side slopes -upstream	Vertical
	-downstream	Vertical and 0.6H:1V
(6)	Zoning	None
(7)	Grout curtain	Unknown

h. Diversion and Regulating Facilities.

(1)	Type	30" pipe
(2)	Elevation	Unknown
(3)	Length	Approximately 100 feet
(4)	Regulation	Valve in pump house

i. Spillway.

(1)	Type	Concrete ogee sill with 21 bays
(2)	Length - total	450 feet
	- effective	407.4 feet
(3)	Crest elevation (sill)	1123.0
(4)	Upstream channel	Lake
(5)	Downstream channel	Emergency spillway discharge channel, open cut with concrete retaining walls
(6)	Weir shape	Sharp crested weir because of flashboards

SECTION 2 - ENGINEERING DATA

2.1 DESIGN. The construction drawings were available in the city office for review. No design reports are known to exist.

2.2 CONSTRUCTION. Construction was completed in 1929. No information is available on construction history of the dam.

2.3 OPERATION. Daily water levels are recorded. In addition, daily consumption is reported.

2.4 EVALUATION.

a. Availability. The construction drawings were the only engineering data available for review.

b. Adequacy. The field surveys and visual inspections presented herein are considered adequate to support the conclusion of this report. Seepage, stability and structural analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" are not on record. This is a deficiency which should be rectified.

c. Validity. Not applicable.

SECTION 3 -VISUAL INSPECTION

3.1 FINDINGS

a. General. The onsite inspection of Lake McDaniel Dam was conducted by personnel of L. Robert Kimball and Associates accompanyed by the owner's engineering staff on June 6 and 7, 1979. The inspection team consisted of a hydrologist, structural/ soils engineer and a geologist. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portions of any outlet works, and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.

b. Project Geology. The bedrock underlying McDaniel Lake Dam consists of the Mississipian aged Burlington-Keokuk limestone formation, which is part of the Osagean Series. This unit may be over 200 feet thick.

This formation is a coarsely crystalline, crinoidal limestone which is white to gray in color. Where the beds are dolomitic, as in the spillway at McDaniel Lake, the color is buff to brown. These beds are rare however. The formation varies from thin bedded to massive, but is usually medium bedded and weathers to even beds.

Gray to white cherts are often contained within the formation in the form of nodules or beds. The chert weathers to white or brown boulders which become tripolitic and reddish brown upon extreme weathering. The cherty section of the formation is probably in the higher part of the formation and appears to have been eroded from many areas.

Water moving through the limestone has dissolved it in many places, forming a highly uneven bedrock surface, enlarged joints and bedding planes, and caverns. Irregularly shaped pinnacles, some of which may be 10 or 15 feet high, are also common in many areas. These features lie between major "paths" of lateral water movement through residual material toward enlarged joints or bedding planes.

There are no major structural features within five miles of the dam. The nearest faults are those to the south, the Valley Mills fault system, and to the southeast on the other side of the Valley Water Mills facility. The strata dip about 1/2 degree to the southwest.

c. Dam and Spillway. Visual inspection of the dam indicated the structure was in good condition. From a brief survey conducted during the inspection, it was determined that no deflection or settlement was noted. In general the concrete in the dam appeared to be in good condition. However, hairlines cracks were noted throughout much of the downstream slope of the dam. The extent of these hairline cracks is unknown. The concrete at the construction joints on the downstream face has deteriorated significantly. In addition, it was noted that seepage is exiting through most of these construction joints. The extent and depth of this concrete disintegration is unknown. In addition, the condition of the concrete on the upstream face of the reservoir is unknown because of the high lake level. The earth berm on the downstream slope of the dam appears to be in good condition. The top of the dam has a new bituminous surfacing.

The concrete in the spillway sill and walls in the exit channel appeared to be in good condition. Seventeen of the twenty-one spillway bays had permanent flashboards in place. Three bays had three feet of flashboards and fourteen bays had two feet of flashboards in place. The remaining four bays had trippable flashboards. One bay had all the tripped flashboards removed and three of the bays had two-thirds of the four feet high flashboards tripped. This indicates that the tripping mechanism on the flashboards is not effective. The spillway approach appeared to contain a considerable amount of sediment and on the right portion small trees were noted. With time this sedimentation and vegetation may obstruct flow into the spillway. The spillway discharge channel bottom is cut in the limestone bedrock. Numerous trees are growing in the bedrock. In addition, the limestone is cavernous and flow enters these caverns instead of flowing on the surface.

Discussions with the owner indicate that design drawings have been developed to replace the flashboards with four feet high flashboards in nineteen of the twenty-one bays. Four of the bays will have trippable flashboards. The remaining two bays will have sluice gates.

d. Outlet Works and Drain Lines. The exposed portions of the outlet works appear to be in good condition. It was reported that the valves on the water supply lines were replaced four years ago. In addition, it is reported that the drainline valve has never been opened.

e. Reservoir Area. No pertinent problems were noted in the reservoir area. The watershed slopes are moderate with woodland and farmland.

f. Downstream Channel. Discharges from the spillway enter the spillway exit channel and enter the Little Sack River. The Little Sack River has a narrow to moderately wide flood plain.

3.2 EVALUATION. Visual inspection revealed that the dam, spillway and outlet works are in good condition. The concrete appears to be in good condition with the exception of hairline cracks and deterioration at the construction joints. The trees and sedimentation should be removed from upstream of the emergency spillway. The trees located in the emergency spillway discharge channel should be removed. The presence of the flashboards in the emergency spillway is questionable. The fact that the reservoir drain line has never been opened indicates that it may not be operable in an emergency.

Complete evaluation of the structure cannot be made without a detailed stability, seepage and stress analysis with test results of the concrete.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES. The reservoir is maintained at or near the spillway crest at all times. Water is drawn off the reservoir on a regular basis (see Section 1.3h). The valves on the water supply lines are normally operated from the Fulbright Treatment Plant but can be operated in the pumphouse. The high lake level in McDaniel Lake is maintained through releases from Fellows Lake, which is located upstream of McDaniel Lake.

4.2 MAINTENANCE OF THE DAM. The walkway on the top of dam has recently been repaired by placing a bituminous surface over the top. No other major maintenance of the dam has been conducted. The maintenance of the dam is considered fair.

4.3 MAINTENANCE OF OPERATING FACILITIES. It is reported that the water supply valves were replaced approximately four years ago. However, the drain line has never been opened. Maintenance of the operating facilities is considered fair.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT. There is no warning system in effect.

4.5 EVALUATION. Maintenance of the dam and operating facilities is considered fair. There is no warning system in effect to warn downstream residences of large spillway discharges or failure of the dam.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. There is no hydraulic or hydrologic design data available.

b. Experience Data. The drainage area was developed using the U.S.G.S. quadrangle sheet. The lake surface area was determined by planimetering the quadrangle sheet. Surface area - elevations were determined by planimetering various contour lines within the drainage area on the U.S.G.S quadrangle sheets. The spillway and dam layout was made from surveys conducted during the inspection.

c. Visual Observations. It is doubtful whether the trippable flashboards are completely functional. The other flashboards could not be removed during flooding.

d. Overtopping Potential. Overtopping potential was investiated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, St. Louis District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydraulic Engineering Center (HEC) U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed in Appendix B.

To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions:

(1) Water level prior to flood was at the spillway crest elevation (elevation 1123.0)

(2) The spillway capacity was determined by assuming the flashboards were positioned as noted during the visual inspection.

(3) No flow through the drain lines or water supply lines was considered.

(4) The storm was routed through Fellows Lake, which in effect, stored a portion of the storm. Fellows Lake Dam was assumed to be stable during flood conditions and not fail. Hydrologic and hydraulic data on Fellows Lake Dam was obtained from the St. Louis District Corps of Engineers.

Complete summary sheets of the computer output are presented in Appendix B. To facilitate review, the major results of the overtopping analysis are presented below:

Peak Inflow	115,349 cfs
Spillway Capacity	9,664 cfs

Ratio of PMF	Maximum Reservoir Water Surface Elevation	Maximum Depth over Dam, ft.	Maximum Outflow, cfs	Duration Over Top, Hours
.10	1128.72	0.02	9,862	0.67
.50	1133.23	4.53	60,497	10.00
.60	1134.03	5.33	71.363	10.67
1.00	1136.73	8.03	114,371	13.67

If the dam were overtopped during a flood, erosion of the earth berm located on the downstream slope of the dam would be highly probable. Erosion of this earth berm may affect the stability of the structure since the earth berm was designed into the structure to act as a buttress and to add weight to the downstream toe of the dam. In addition, during an overtopping event, the ability of the trippable flashboards to be tripped is questionable.

The Corps of Engineers Spillway Design Flood for a high hazard-intermediate dam is the PMF. The spillway is capable of controlling less than 10% of the PMF without overtopping the dam under conditions observed during the visual inspection. In addition, it was determined that if all the flashboards were to be removed, the spillway would only be able to control approximately 16% of the PMF without overtopping the dam. Because of the low spillway capacity, the 10-year storm was routed through the reservoir. It was determined that the spillway cannot control the 10-year storm without overtopping the dam with the flashboards in place. If the flashboards were removed, the spillway could safely pass the 10-year storm. Removing the flashboards would nearly double the discharge capacity of the spillway.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations did not reveal any immediate signs of instability. The hairline cracks and deterioration of the concrete, and seepage at the construction joints are not of immediate concern. However, repairs should be made to these features before conditions worsen. Close examination of all the concrete on the downstream slope and the concrete on the upstream slope was impossible.

b. Design and Construction Data. No testing of the concrete is known to exist. Stability, stress and seepage analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" is not available, which is a deficiency.

c. Operating Records. The only operating records that exist are water levels in the reservoir and daily consumption.

d. Post Construction Changes. The only post construction changes to the dam and outlet works were the bituminous paving on the crest and replacement of the water supply valves.

e. Seismic Stability. The dam is located in seismic zone 2, to which the guidelines assess a "moderate" damage potential. No seismic structural stability analysis has been conducted.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The visual observations, review of available data, hydrologic calculations and past operational performance indicate that the McDaniel Lake Dam's spillway is capable of controlling less than 10% of the PMF without overtopping the dam. In addition, the spillway is not capable of controlling the 10-year storm with the flashboards in place. Because of the presence of the earth berm at the downstream toe of the dam, which probably would be eroded during overtopping of the dam, the structural stability of the dam during major flooding is questionable. The concrete portion of the dam is a rather thin section and the earth berm was probably used in the overturning and sliding analyses.

The dam appeared to be in good condition. The cracks in the dam should be mapped and monitored at regular intervals. The deterioration of the concrete in the construction joints should be repaired. The vegetation and sedimentation upstream of the emergency should be removed. The vegetation in the emergency spillway channel should be removed.

No design reports are available on the dam. Seepage, stability and structural analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

It must be noted that dams deteriorate and change with time. Safety reviews for this structure should be made on an on-going basis. Periodic inspections should be conducted of the dam.

b. Adequacy of Information. Complete assessment of the structural stability of the structure cannot be made because of the limited design data, construction data and no past stability, stress or seepage analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams", which is considered a deficiency.

c. Urgency. The deficiencies described herein are serious and corrective actions listed below should be initiated promptly. High priority should be assigned to gaining additional spillway capacity.

d. Need for Phase II. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

a. Remove all flashboards immediately to increase spillway capacity.

b. A registered professional engineer knowledgeable in concrete dam design should be retained to perform a detailed hydrologic analysis to increase spillway capacity to criteria in the "Recommended Guidelines for Safety Inspection of Dams". Consideration should be given to increasing spillway size and/or height of dam for spillway to comply with the SDF.

c. A stability, stress and seepage analysis comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" should be conducted by a registered professional engineer knowledgeable in concrete dams.

d. The hairline cracks in the dam should be mapped and monitored at regular intervals.

e. The deteriorated concrete in the construction joints should be repaired.

f. The drain line valve should be operated and lubricated on a regularly scheduled basis.

g. Institute a formal warning system to warn downstream residences of high spillway discharges or failure of the dam.

h. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of concrete dams.

APPENDIX A

DRAWINGS

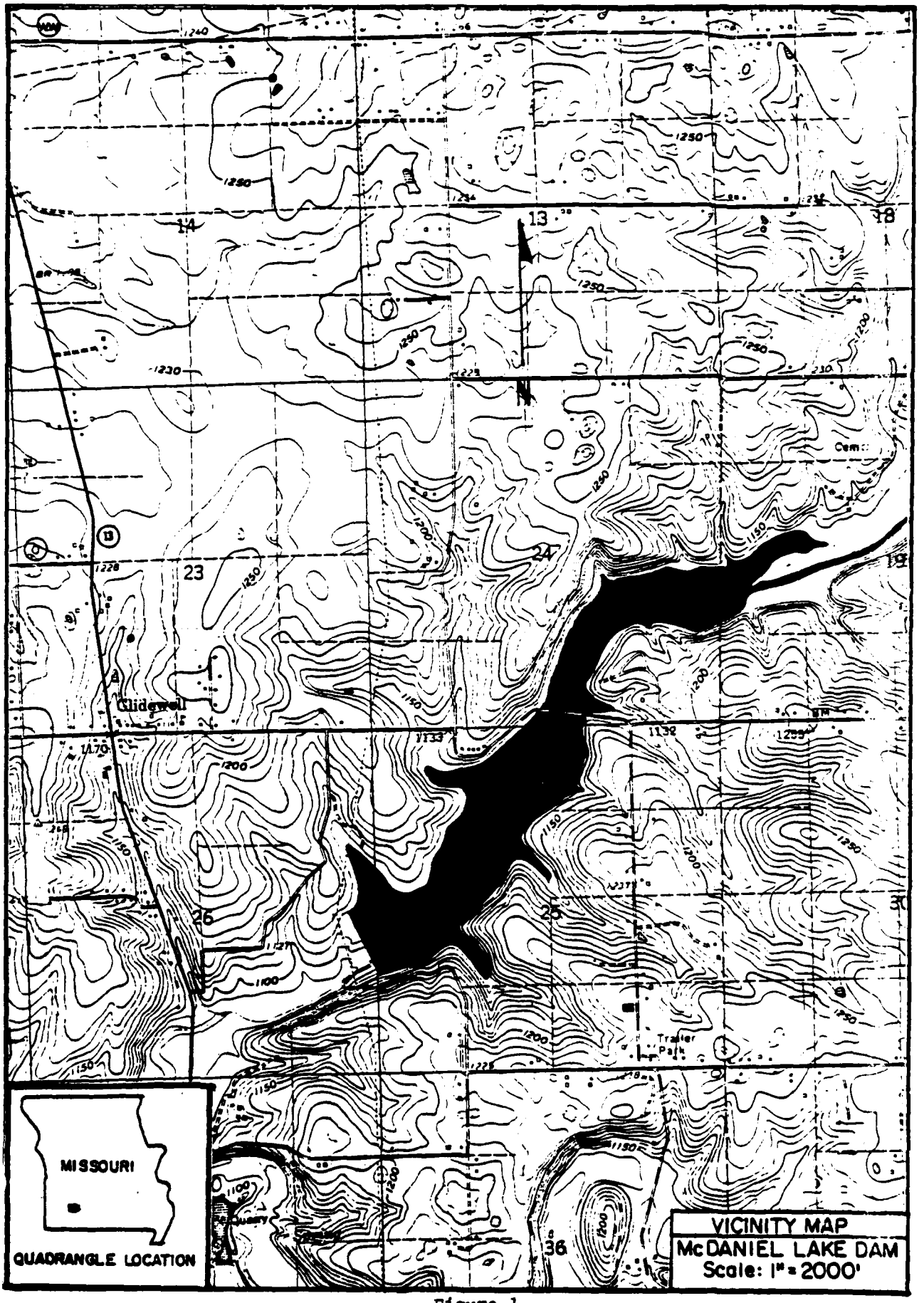

MISSOURI
QUADRANGLE LOCATION
VICINITY MAP
McDANIEL LAKE DAM
Scale: 1" = 2000'
Glidewell
Trailer Park
Quarry
Cem.
13
14
18
19
23
24
25
26
30
36

Figure 1

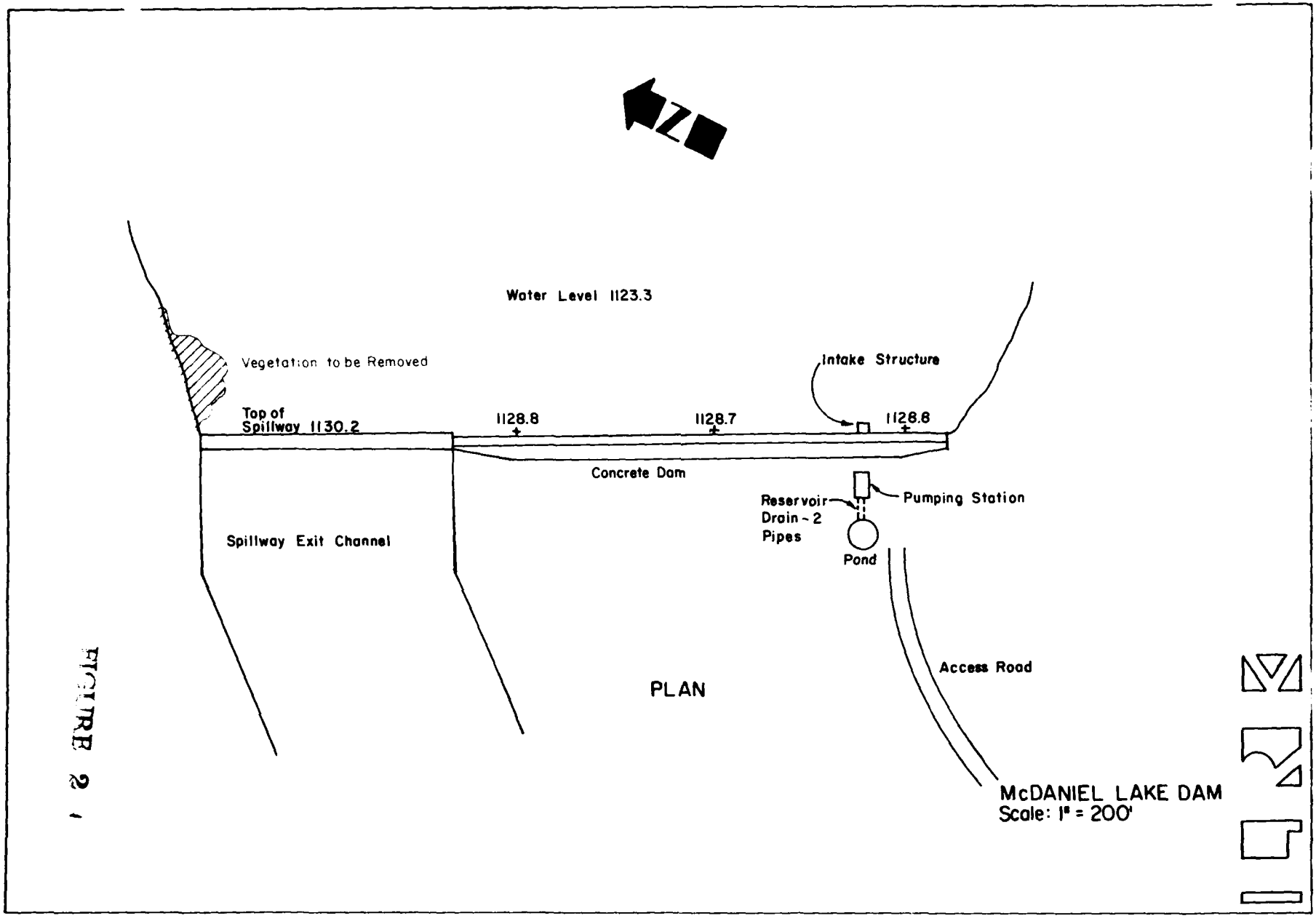
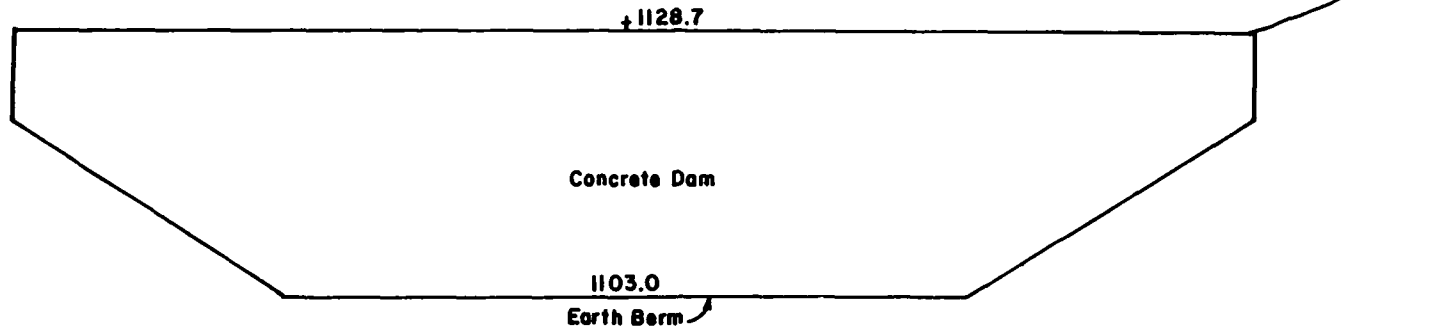
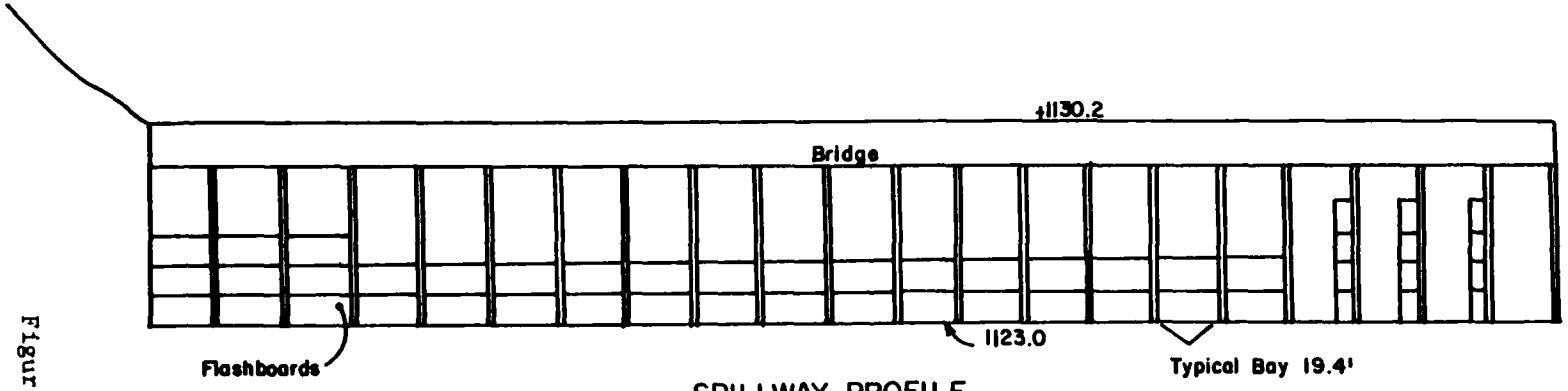

Water Level 1123.3
Vegetation to be Removed
Intake Structure
Top of
Spillway 1130.2
1128.8
1128.7
1128.6
Concrete Dam
Reservoir
Drain - 2
Pipes
Pumping Station
Pond
Spillway Exit Channel
Access Road
PLAN
McDANIEL LAKE DAM
Scale: 1" = 200'

FIGURE 2



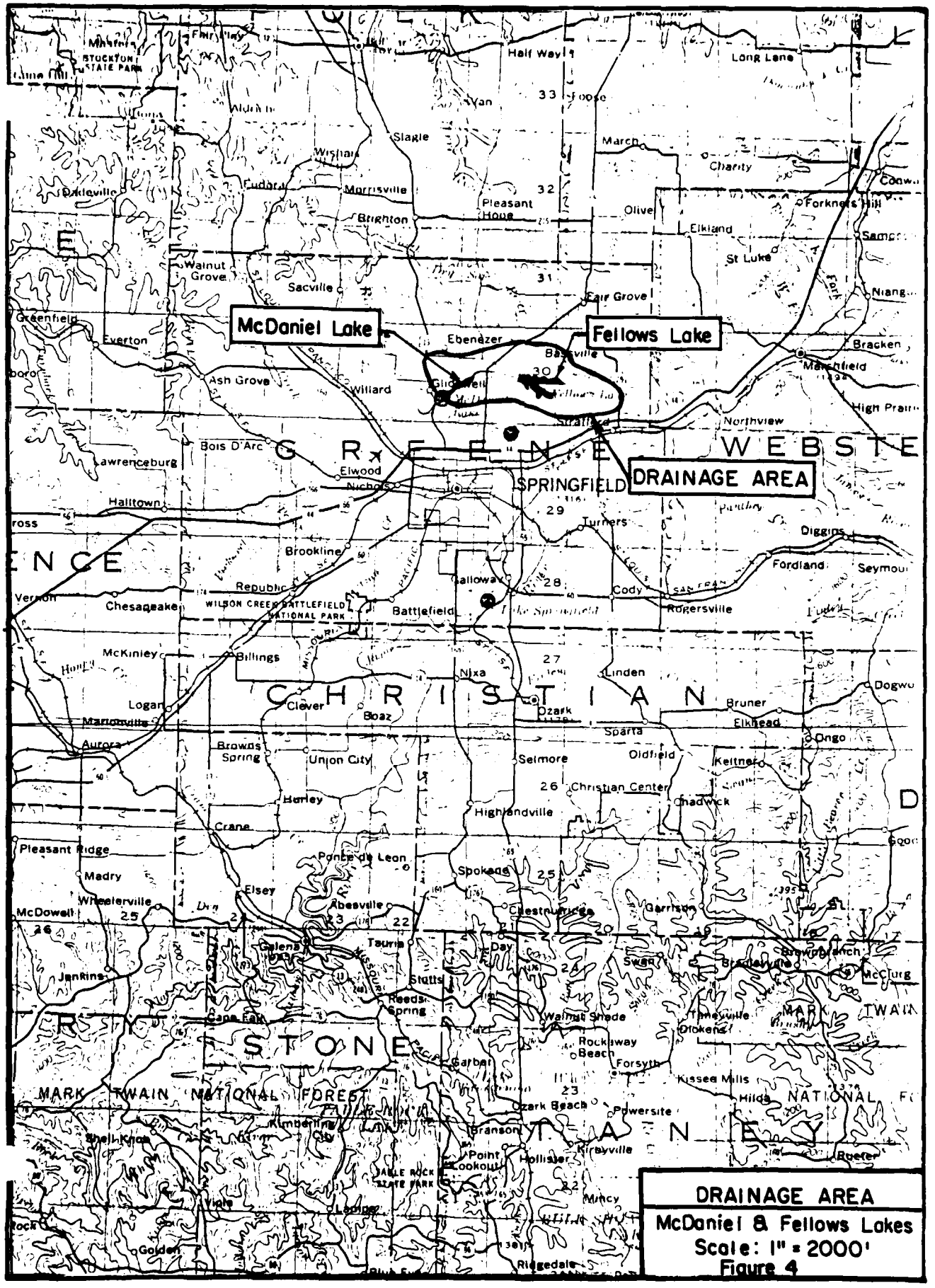
DAM PROFILE
Scale: H: 1" = 100'
V: 1" = 20'



SPILLWAY PROFILE
Scale: H: 1" = 60'
V: 1" = 6'

McDANIEL LAKE DAM

Figure 3


McDaniel Lake
Fellows Lake
DRAINAGE AREA
SPRINGFIELD
GREENE
WEBSTER
CHRISTIAN
STONE
TANEY
MARK TWAIN NATIONAL FOREST
WILSON CREEK BATTLEFIELD NATIONAL PARK
BARRY
Stockton State Park
Half Way
Long Lane
Van Loose
Slagle
March
Charity
Wishart
Dudley
Morrisville
Pleasant Hope
Olive
Elkland
Forkner's Hill
Walnut Grove
Sacville
St Luke
Fair Grove
Greenfield
Everton
Ebenezer
Bracken
Ash Grove
Willard
Northview
Bois D'Arc
Lawrenceburg
Elwood
Halltown
Turners
Diggins
Brookline
Fordland
Republic
Galloway
Cody
Vernon
Chesapeake
Battlefield
Rogersville
McKinley
Billings
Nixa
Linden
Logan
Clever
Ozark
Bruner
Marionville
Boaz
Sparta
Elkhead
Aurora
Browns Spring
Union City
Selmore
Oldfield
Keltner
Christian Center
Chadwick
Hurley
Highlandville
Crane
Pleasant Ridge
Ponce de Leon
Madry
Spokane
Elsey
Abesville
McDowell
Wheelerville
Chestnutridge
Garrison
Galena
Taurus
Day
Swan
Jenkins
Stotts
Reeds Spring
Cape Fair
Walnut Shade
Timeyville
Dickens
Rockaway Beach
Garber
Forsyth
Kissee Mills
Ozark Beach
Powersite
Shell Knob
Kimberling City
Branson
Point Lookout
Hollister
Kirbyville
Table Rock State Park
Viola
Lampe
Mincy
Golden
Ridgedale
DRAINAGE AREA
McDaniel & Fellows Lakes
Scale: 1" = 2000'
Figure 4

APPENDIX B

HYDROLOGY AND HYDRAULICS

APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors have not been applied. A 48 hour storm duration is assumed with total depth distributed over 6 hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6 hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6 hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use, and antecedent moisture conditions.

Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

The above analysis has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed in the computer printout. Definitions of these variables are contained in the "User's Manual" for the computer program.

The inflow hydrograph was routed through the reservoir using HEC-1's Modified Puls option.

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME McDANIEL LAKE DAM
I.D. NUMBER 20038
SHEET NO. 1 OF 3
BY OTM DATE 7-27-79

McDANIEL LAKE DAM

DRAINAGE AREA

AREA = 39 SQ. MI.

NOTE: 20.1 SQ. MI. REPRESENTS THE DRAINAGE AREA OF FELLOWS LAKE UPSTREAM OF McDANIEL LAKE.

(FROM ST. LOUIS DISTRICT C.O.E. AND U.S.G.S. 7.5-MIN. QUADS.)

UNIT HYDROGRAPH PARAMETERS

KIRPICH METHOD:

t_R = 3.7 HRS., LAG (L) = 0.6 t_R = 2.22 HRS

WHERE (L) = 44,000 FT. = LENGTH
(H) = 227 FT. = HEIGHT

(FROM, TIME OF CONCENTRATION NOMOGRAPH, KENTUCKY BUREAU OF HIGHWAYS)

CURVE NUMBER METHOD:

$$\text{LAG (L)} = \frac{l^{0.8}(S+1)^{0.7}}{1900\, Y^{0.5}} = \frac{(44{,}000)^{0.8}(3.05)^{0.7}}{1900\,(5)^{1/2}}$$

$$= \frac{(5185)(2.18)}{4248.5} = 2.66 \text{ HRS.}$$

WHERE l = GREATEST FLOW LENGTH IN FEET.

$S = \frac{1000}{CN} - 10$ AND CN = CURVE NUMBER
Y = AVERAGE SLOPE (%)

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME McDANIEL LAKE DAM
I.D. NUMBER 20038
SHEET NO. 2 OF 3
BY OTM DATE 7-27-79

LOSS RATE AND BASE FLOW

STRTL = 1 INCH
CNSTL = 83 *SCS CURVE NUMBER
STRTQ = 1.5 cfs/M.^{2}
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2.0

* UTILIZED ANTECEDENT MOISTURE CONDITION III

PROBABLE MAXIMUM STORM

FROM H.R. No. 33

PMP INDEX RAINFALL (ZONE #7) = 26.5 INCHES
R_6 = 95%, R_{12} = 113%, R_{24} = 123%, R_{48} = 133%

ELEVATION - AREA - CAPACITY - RELATIONSHIP

SPILLWAY CREST ELEV. = 1123', AREA = 226 ACRES
INITIAL STORAGE = 3529 AC.FT

ELEV. 1130, AREA = 331 ACRES
ELEV. 1140, AREA = 404 ACRES
ELEV. 1150, AREA = 493 ACRES

FROM CONIC METHOD FOR RESERVOIR VOLUME. FLOOD HYDROGRAPH PACKAGE (HEC-1). DAM SAFETY VERSION. (USERS MANUAL).

$H = 3V/A = 3(3529)/226 \simeq 47'$

ELEV. WHERE CAPACITY EQUALS ZERO;
1123 - 47 = 1076

AREA (AC.)	0	226	331	404	493
ELEVATION (FT.)	1076	1123	1130	1140	1150

DISCHARGE RATING CURVE

(SPILLWAY)

OVERTOP PARAMETERS (DAM)

TOP OF DAM ELEV. = 1128.7
LENGTH = $\#L_{MAX}$ = 1109.5' C_3 = 3.0

ELEV. (FT.)	WEIR FLOW (C_1=3.3) FROM: $Q = CLH^{3/2}$						ORIFICE FLOW C_2 = 0.60 FROM: $Q = \frac{2}{3} C_2 \sqrt{2g} L (H_2^{3/2} - H_1^{3/2})$ $L_1 = l_1$, $L_2 = l_2$, $L_3 = l_3$ "HANDBOOK OF APPLIED HYDRAULICS" DAVIS & SORENSEN P. 2-30			WEIR FLOW C_3 = 3.1 OVERTOP FOOT BRIDGE $l_4 = l_1 + l_2 + l_3$ = 407.4'		*DISCHARGE (CFS)
	l_1 = 58.2'		l_2 = 278'		l_3 = 71.2							
	h_1 (FT.)	Q_1 (CFS)	H_2 (FT)	Q_2 (CFS)	h_3 (FT)	Q_3 (CFS)	Q_1' (CFS)	Q_2' (CFS)	Q_3' (CFS)	h_4 (FT)	Q_4 (CFS)	*ROUNDED TO NEAREST 10 CFS
1123	0	0										0
1124	1	192										190
1125	2	543										540
1126	3	998	1	917								1920
1127	4	1536	2	2529								4130
1128	5	2147	3	4767	1	235						7150
1128.7	5.7	2614	3.7	6529	1.7	521						9660
1130.2							3266	15,601	3996			22860
1131							3576	17079	4374	0.8	904	25930
1132							3924	18745	4801	1.8	3050	30520
1134							4536	21668	5550	3.8	9355	41110
1136							5072	24227	6205	5.8	17641	53150
1138							5555	26534	6796	7.8	27512	66400
1140							5998	28652	7338	9.8	38746	80730
1150							7845	37473	9597	19.8	111271	166190

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME McDANIEL LAKE DAM
I.D. NUMBER 20038
SHEET NO. 3 OF 3
BY CTM DATE 7-30-79

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
     1          A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
     2          A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF MCDANIEL LAKE DAM
     3          A3       RATIOS OF PMF ROUTED THROUGH FELLOWS DAM AND MCDANIEL (MISSOURI-20038)
     4          B   288      0      10       0       0       0       0       0       0       0
     5          I     5
     6          J     1      4       1
     7          J1   .1     .5      .6       1
     8          K     0   SOUTH                          1       3       1
     9          1       INFLOW HYDROGRAPH SOUTH BRANCH
    10          M     1      2    5.52      39                      1                       1
    11          P           26.8      99     115     123     134
    12          T                                                          -1     -89              0.02
    13          W2          1.50
    14          X   -6.4   -0.10     2.0
    15          K     0   NORTH                          1       3       1
    16          1       INFLOW HYDROGRAPH NORTH BRANCH
    17          M     1      2    7.37      39                      1                       1
    18          P           26.8      99     115     123     134
    19          T                                                          -1     -89              0.2
    20          W2          1.75
    21          X   -6.4   -0.10     2.0
    22          K     0     LCL                          1       3       1
    23          1       INFLOW HYDROGRAPH LOCAL TRIBUTARY AREA
    24          M     1      2    3.60                      1                       1
    25          P           26.8      99     115     123     134
    26          T                                                          -1     -89              0.02
    27          W2          0.66
    28          X  -1.3    -0.10     2.0
    29          K     0    DIRCT                          1       3       1
    30          1       INFLOW HYDROGRAPH DIRECTLY TRIBUTARY AREAS
    31          M     1      2    3.60                      1                       1
    32          P           26.8      99     115     123     134
```

```
33          T                                                                -1      -89          0.34
34          W2          0.65
35          X   -0.1    -0.10     2.0
36          K     4     COMB                                  1       2      1
37          1       COMBINED HYDROGRAPH OF INFLOW
38          K     1     DAM                                   2       2      1
39          1       ROUTING THROUGH RESERVOIR + OVER SPILLWAY
40          Y                                           1     1
41          Y1    1                                                    -1261.0      -1
42          Y41261.0 1261.01 1261.05 1261.10 1261.20 1261.50 1262.00 1262.50 1263.00 1264.00
43          Y41265.0  1266.0  1267.0  1268.0  1269.0  1270.0  1271.0  1272.0  1273.0  1275.0
44          Y5   0.0     2.4    27.0    76.0   216.0   854.0  2415.0  4437.0  6831.0 12550.0
45          Y519320.  26500.  32000.  36000.  41000.  45000.  48200.  53200.  56800.  64000.
46          $A    0.     17.     51.    120.    221.    314.    412.    504.    624.    751.
47          $A  904.   1212.
48          $E 1170    1180    1190    1200    1210    1220    1230    1240    1250    1260
49          $E 1270    1280
50          $$1261.0
```

```
SD 1273.     2.8      1.5   2000.
K     1      1                                                  1
K1       CHANNEL ROUTING - MOD PULS REACH 1
Y                                          1       1
Y1    1
Y6   .06     .09      .06   1155    1170    4000  0.0038
Y7     0    1170      400   1160     893    1156     895    1155     905    1155
Y7   907    1156     1200   1160    1700    1170
K     1      2                                                  1
K1       CHANNEL ROUTING - MOD PULS REACH 2
Y                                          1       1
Y1    1
Y6   .06     .05      .06   1131    1150    6000  0.0040
Y7     0    1150      350   1140     443    1132     445    1131     455    1131
Y7   457    1132      550   1140     750    1150
K     1      3                                                  1
K1       CHANNEL ROUTING - MOD PULS REACH 3
Y                                          1       1
Y1    1
Y6   .06     .05      .06   1122    1140    6000  0.0015
Y7     0    1140      350   1130     493    1123     495    1122     505    1122
Y7   507    1123      675   1130     850    1140
K     0      4                                                  1
K1       INFLOW (SUB-AREA)
M     1      2     18.9                 39      1                         1
P           28.5     99     113     121     131
T                                                        -1      -83
W2          2.22
X    -1.5    -.10    2.0
K     2      5                                                  1
K1       COMBINE
K     1      5                                                  1
K1       ROUTE THROUGH RESERVOIR (MCDANIEL LAKE)
Y                                          1       1
Y1    1                                                  -1123     -1
Y4  1123    1124     1125   1126    1127    1128  1128.7  1130.2    1131    1132
Y4  1134    1136     1138   1140    1150
```

```
88          Y5      0     192     543    1915    4131    7149    9664   22863   25933   30520
89          Y5  41109   53145   66397   80734  166186
90          $A      0     226     331     404     493
91          $E   1076    1123    1130    1140    1150
92          $$   1123
93          $D1128.7       3.0     1.5  1109.5
94          $L  767.5   770.5   783.5   896.5  1109.5
95          $V1128.7    1129    1130    1140    1150
96          K       99
```

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE 79/09/05.
TIME 10.10.36.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF MCDANIEL LAKE DAM
RATIOS OF PMF ROUTED THROUGH FELLOWS DAM AND MCDANIEL (MISSOURI-20038)

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	10	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1

RTIOS= .10 .30 .60 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH SOUTH BRANCH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
SOUTH	0	0	0	1	3	1	0.	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	IRKSDA	IRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	5.52	39.00	5.52	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	26.80	99.00	115.00	123.00	134.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-89.00	0.00	.02

CURVE NO = -89.00 WETNESS = -1.00 EFFECT CN = 89.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 1.50

RECESSION DATA
STRTQ= -6.40 QRCSN= .10 RTIOR= 2.00

UNIT HYDROGRAPH 47 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 1.50 VOL= 1.00

57.	185.	352.	579.	877.	1198.	1451.	1610.	1677.	1677.	
1610.	1493.	1358.	1191.	987.	802.	670.	562.	472.	407.	
344.	290.	241.	205.	172.	146.	122.	102.	86.	73.	
62.	52.	44.	37.	31.	26.	22.	19.	16.	14.	
12.	10.	8.	6.	4.	3.	1.				

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.10	1	.00	.00	.00	33.	1.02	.10	145	.02	.02	.00	66.
1.01	.20	2	.00	.00	.00	31.	1.02	.20	146	.02	.02	.00	69.
1.01	.30	3	.00	.00	.00	29.	1.02	.30	147	.02	.02	.00	75.
1.01	.40	4	.00	.00	.00	27.	1.02	.40	148	.02	.02	.00	85.
1.01	.50	5	.00	.00	.00	25.	1.02	.50	149	.02	.02	.00	101.
1.01	1.00	6	.00	.00	.00	23.	1.02	1.00	150	.02	.02	.00	123.
1.01	1.10	7	.00	.00	.00	22.	1.02	1.10	151	.02	.02	.00	150.

1.01	1.20	8	.00	.00	.00	21.	1.02	1.20	152	.02	.02	.00	180.
1.01	1.30	9	.00	.00	.00	19.	1.02	1.30	153	.02	.02	.00	211.
1.01	1.40	10	.00	.00	.00	18.	1.02	1.40	154	.02	.02	.00	243.
1.01	1.50	11	.00	.00	.00	17.	1.02	1.50	155	.02	.02	.00	273.
1.01	2.00	12	.00	.00	.00	16.	1.02	2.00	156	.02	.02	.00	301.
1.01	2.10	13	.00	.00	.00	15.	1.02	2.10	157	.02	.02	.00	327.
1.01	2.20	14	.00	.00	.00	14.	1.02	2.20	158	.02	.02	.00	349.
1.01	2.30	15	.00	.00	.00	13.	1.02	2.30	159	.02	.02	.00	368.
1.01	2.40	16	.00	.00	.00	12.	1.02	2.40	160	.02	.02	.00	383.
1.01	2.50	17	.00	.00	.00	12.	1.02	2.50	161	.02	.02	.00	396.
1.01	3.00	18	.00	.00	.00	11.	1.02	3.00	162	.02	.02	.00	407.
1.01	3.10	19	.00	.00	.00	10.	1.02	3.10	163	.02	.02	.00	416.
1.01	3.20	20	.00	.00	.00	10.	1.02	3.20	164	.02	.02	.00	424.
1.01	3.30	21	.00	.00	.00	9.	1.02	3.30	165	.02	.02	.00	431.
1.01	3.40	22	.00	.00	.00	9.	1.02	3.40	166	.02	.02	.00	437.
1.01	3.50	23	.00	.00	.00	8.	1.02	3.50	167	.02	.02	.00	442.
1.01	4.00	24	.00	.00	.00	8.	1.02	4.00	168	.02	.02	.00	446.
1.01	4.10	25	.00	.00	.00	7.	1.02	4.10	169	.02	.02	.00	450.
1.01	4.20	26	.00	.00	.00	7.	1.02	4.20	170	.02	.02	.00	453.
1.01	4.30	27	.00	.00	.00	6.	1.02	4.30	171	.02	.02	.00	456.
1.01	4.40	28	.00	.00	.00	6.	1.02	4.40	172	.02	.02	.00	458.
1.01	4.50	29	.00	.00	.00	6.	1.02	4.50	173	.02	.02	.00	460.
1.01	5.00	30	.00	.00	.00	5.	1.02	5.00	174	.02	.02	.00	462.
1.01	5.10	31	.00	.00	.00	5.	1.02	5.10	175	.02	.02	.00	464.
1.01	5.20	32	.00	.00	.00	5.	1.02	5.20	176	.02	.02	.00	465.
1.01	5.30	33	.00	.00	.00	4.	1.02	5.30	177	.02	.02	.00	466.
1.01	5.40	34	.00	.00	.00	4.	1.02	5.40	178	.02	.02	.00	467.
1.01	5.50	35	.00	.00	.00	4.	1.02	5.50	179	.02	.02	.00	468.
1.01	6.00	36	.00	.00	.00	4.	1.02	6.00	180	.02	.02	.00	469.
1.01	6.10	37	.01	.00	.01	4.	1.02	6.10	181	.12	.11	.01	475.
1.01	6.20	38	.01	.00	.01	3.	1.02	6.20	182	.12	.11	.01	492.
1.01	6.30	39	.01	.00	.01	3.	1.02	6.30	183	.12	.11	.01	525.
1.01	6.40	40	.01	.00	.01	3.	1.02	6.40	184	.12	.11	.01	577.
1.01	6.50	41	.01	.00	.01	3.	1.02	6.50	185	.12	.11	.01	656.
1.01	7.00	42	.01	.00	.01	3.	1.02	7.00	186	.12	.11	.01	764.
1.01	7.10	43	.01	.00	.01	4.	1.02	7.10	187	.12	.11	.01	895.

1.01	7.20	44	.01	.00	.01	4.	1.02	7.20	188	.12	.11	.01	1041.
1.01	7.30	45	.01	.00	.01	4.	1.02	7.30	189	.12	.11	.01	1193.
1.01	7.40	46	.01	.00	.01	4.	1.02	7.40	190	.12	.11	.01	1346.
1.01	7.50	47	.01	.00	.01	4.	1.02	7.50	191	.12	.11	.00	1492.
1.01	8.00	48	.01	.00	.01	4.	1.02	8.00	192	.12	.11	.00	1629.
1.01	8.10	49	.01	.00	.01	5.	1.02	8.10	193	.12	.11	.00	1754.
1.01	8.20	50	.01	.00	.01	5.	1.02	8.20	194	.12	.11	.00	1864.
1.01	8.30	51	.01	.00	.01	5.	1.02	8.30	195	.12	.11	.00	1957.
1.01	8.40	52	.01	.00	.01	5.	1.02	8.40	196	.12	.12	.00	2032.
1.01	8.50	53	.01	.00	.01	5.	1.02	8.50	197	.12	.12	.00	2096.
1.01	9.00	54	.01	.00	.01	5.	1.02	9.00	198	.12	.12	.00	2151.
1.01	9.10	55	.01	.00	.01	5.	1.02	9.10	199	.12	.12	.00	2197.
1.01	9.20	56	.01	.00	.01	5.	1.02	9.20	200	.12	.12	.00	2237.
1.01	9.30	57	.01	.00	.01	5.	1.02	9.30	201	.12	.12	.00	2272.
1.01	9.40	58	.01	.00	.01	6.	1.02	9.40	202	.12	.12	.00	2302.
1.01	9.50	59	.01	.00	.01	7.	1.02	9.50	203	.12	.12	.00	2327.
1.01	10.00	60	.01	.00	.01	8.	1.02	10.00	204	.12	.12	.00	2349.
1.01	10.10	61	.01	.00	.01	9.	1.02	10.10	205	.12	.12	.00	2368.
1.01	10.20	62	.01	.00	.01	10.	1.02	10.20	206	.12	.12	.00	2384.
1.01	10.30	63	.01	.00	.01	12.	1.02	10.30	207	.12	.12	.00	2398.
1.01	10.40	64	.01	.00	.01	14.	1.02	10.40	208	.12	.12	.00	2410.
1.01	10.50	65	.01	.00	.01	16.	1.02	10.50	209	.12	.12	.00	2421.
1.01	11.00	66	.01	.00	.01	18.	1.02	11.00	210	.12	.12	.00	2430.
1.01	11.10	67	.01	.00	.01	21.	1.02	11.10	211	.12	.12	.00	2439.
1.01	11.20	68	.01	.00	.01	23.	1.02	11.20	212	.12	.12	.00	2446.
1.01	11.30	69	.01	.00	.01	26.	1.02	11.30	213	.12	.12	.00	2452.
1.01	11.40	70	.01	.00	.01	29.	1.02	11.40	214	.12	.12	.00	2458.
1.01	11.50	71	.01	.00	.01	31.	1.02	11.50	215	.12	.12	.00	2463.
1.01	12.00	72	.01	.00	.01	34.	1.02	12.00	216	.12	.12	.00	2467.
1.01	12.10	73	.04	.01	.03	37.	1.02	12.10	217	.44	.43	.01	2489.
1.01	12.20	74	.04	.01	.03	42.	1.02	12.20	218	.44	.44	.01	2592.
1.01	12.30	75	.04	.01	.02	48.	1.02	12.30	219	.44	.44	.01	2667.
1.01	12.40	76	.04	.02	.02	57.	1.02	12.40	220	.44	.44	.01	2854.
1.01	12.50	77	.04	.02	.02	69.	1.02	12.50	221	.44	.44	.01	3136.
1.01	13.00	78	.04	.02	.02	84.	1.02	13.00	222	.44	.44	.00	3520.
1.01	13.10	79	.05	.02	.02	104.	1.02	13.10	223	.53	.53	.01	3990.

1.01	13.20	80	.05	.02	.02	127.	1.02	13.20	224	.53	.53	.01	4522.
1.01	13.30	81	.05	.03	.02	153.	1.02	13.30	225	.53	.53	.00	5091.
1.01	13.40	82	.05	.03	.02	182.	1.02	13.40	226	.53	.53	.00	5679.
1.01	13.50	83	.05	.03	.02	213.	1.02	13.50	227	.53	.53	.00	6273.
1.01	14.00	84	.05	.03	.02	246.	1.02	14.00	228	.53	.53	.00	6859.
1.01	14.10	85	.06	.04	.02	281.	1.02	14.10	229	.66	.66	.00	7431.
1.01	14.20	86	.06	.04	.02	317.	1.02	14.20	230	.66	.66	.00	7982.
1.01	14.30	87	.06	.04	.02	353.	1.02	14.30	231	.66	.66	.00	8495.
1.01	14.40	88	.06	.04	.02	391.	1.02	14.40	232	.66	.66	.00	8981.
1.01	14.50	89	.06	.04	.02	429.	1.02	14.50	233	.66	.66	.00	9457.
1.01	15.00	90	.06	.04	.02	470.	1.02	15.00	234	.66	.66	.00	9932.
1.01	15.10	91	.05	.04	.01	511.	1.02	15.10	235	.60	.60	.00	10395.
1.01	15.20	92	.09	.07	.02	553.	1.02	15.20	236	1.01	1.00	.00	10860.
1.01	15.30	93	.16	.12	.04	600.	1.02	15.30	237	1.81	1.81	.01	11383.
1.01	15.40	94	.41	.33	.08	669.	1.02	15.40	238	4.54	4.53	.01	12184.
1.01	15.50	95	.12	.10	.02	764.	1.02	15.50	239	1.31	1.31	.00	13321.
1.01	16.00	96	.07	.06	.01	879.	1.02	16.00	240	.81	.81	.00	14722.
1.01	16.10	97	.06	.05	.01	1019.	1.02	16.10	241	.62	.62	.00	16442.
1.01	16.20	98	.06	.05	.01	1180.	1.02	16.20	242	.62	.62	.00	18444.
1.01	16.30	99	.06	.05	.01	1343.	1.02	16.30	243	.62	.62	.00	20441.
1.01	16.40	100	.06	.05	.01	1478.	1.02	16.40	244	.62	.62	.00	22018.
1.01	16.50	101	.06	.05	.01	1571.	1.02	16.50	245	.62	.62	.00	23028.
1.01	17.00	102	.06	.05	.01	1624.	1.02	17.00	246	.62	.62	.00	23476.
1.01	17.10	103	.04	.04	.01	1642.	1.02	17.10	247	.49	.49	.00	23464.
1.01	17.20	104	.04	.04	.00	1629.	1.02	17.20	248	.49	.49	.00	23037.
1.01	17.30	105	.04	.04	.00	1592.	1.02	17.30	249	.49	.49	.00	22293.
1.01	17.40	106	.04	.04	.00	1538.	1.02	17.40	250	.49	.49	.00	21345.
1.01	17.50	107	.04	.04	.00	1466.	1.02	17.50	251	.49	.49	.00	20171.
1.01	18.00	108	.04	.04	.00	1380.	1.02	18.00	252	.49	.49	.00	18824.
1.01	18.10	109	.00	.00	.00	1296.	1.02	18.10	253	.04	.04	.00	17532.
1.01	18.20	110	.00	.00	.00	1221.	1.02	18.20	254	.04	.04	.00	16404.
1.01	18.30	111	.00	.00	.00	1151.	1.02	18.30	255	.04	.04	.00	15355.
1.01	18.40	112	.00	.00	.00	1080.	1.02	18.40	256	.04	.04	.00	14332.
1.01	18.50	113	.00	.00	.00	1008.	1.02	18.50	257	.04	.04	.00	13301.
1.01	19.00	114	.00	.00	.00	927.	1.02	19.00	258	.04	.04	.00	12179.
1.01	19.10	115	.00	.00	.00	841.	1.02	19.10	259	.04	.04	.00	11016.

1.01	19.20	116	.00	.00	.00	753.	1.02	19.20	260	.04	.04	.00	9841.
1.01	19.30	117	.00	.00	.00	670.	1.02	19.30	261	.04	.04	.00	8727.
1.01	19.40	118	.00	.00	.00	589.	1.02	19.40	262	.04	.04	.00	7666.
1.01	19.50	119	.00	.00	.00	515.	1.02	19.50	263	.04	.04	.00	6686.
1.01	20.00	120	.00	.00	.00	447.	1.02	20.00	264	.04	.04	.00	5794.
1.01	20.10	121	.00	.00	.00	386.	1.02	20.10	265	.04	.04	.00	4999.
1.01	20.20	122	.00	.00	.00	333.	1.02	20.20	266	.04	.04	.00	4308.
1.01	20.30	123	.00	.00	.00	289.	1.02	20.30	267	.04	.04	.00	3735.
1.01	20.40	124	.00	.00	.00	253.	1.02	20.40	268	.04	.04	.00	3266.
1.01	20.50	125	.00	.00	.00	223.	1.02	20.50	269	.04	.04	.00	2873.
1.01	21.00	126	.00	.00	.00	198.	1.02	21.00	270	.04	.04	.00	2543.
1.01	21.10	127	.00	.00	.00	177.	1.02	21.10	271	.04	.04	.00	2300.
1.01	21.20	128	.00	.00	.00	161.	1.02	21.20	272	.04	.04	.00	2146.
1.01	21.30	129	.00	.00	.00	150.	1.02	21.30	273	.04	.04	.00	2003.
1.01	21.40	130	.00	.00	.00	140.	1.02	21.40	274	.04	.04	.00	1869.
1.01	21.50	131	.00	.00	.00	131.	1.02	21.50	275	.04	.04	.00	1743.
1.01	22.00	132	.00	.00	.00	122.	1.02	22.00	276	.04	.04	.00	1627.
1.01	22.10	133	.00	.00	.00	114.	1.02	22.10	277	.04	.04	.00	1518.
1.01	22.20	134	.00	.00	.00	106.	1.02	22.20	278	.04	.04	.00	1416.
1.01	22.30	135	.00	.00	.00	99.	1.02	22.30	279	.04	.04	.00	1321.
1.01	22.40	136	.00	.00	.00	92.	1.02	22.40	280	.04	.04	.00	1233.
1.01	22.50	137	.00	.00	.00	86.	1.02	22.50	281	.04	.04	.00	1150.
1.01	23.00	138	.00	.00	.00	80.	1.02	23.00	282	.04	.04	.00	1073.
1.01	23.10	139	.00	.00	.00	75.	1.02	23.10	283	.04	.04	.00	1001.
1.01	23.20	140	.00	.00	.00	72.	1.02	23.20	284	.04	.04	.00	934.
1.01	23.30	141	.00	.00	.00	70.	1.02	23.30	285	.04	.04	.00	872.
1.01	23.40	142	.00	.00	.00	68.	1.02	23.40	286	.04	.04	.00	846.
1.01	23.50	143	.00	.00	.00	67.	1.02	23.50	287	.04	.04	.00	830.
1.02	0.00	144	.00	.00	.00	66.	1.03	0.00	288	.04	.04	.00	818.
									SUM	35.91	34.50	1.41	730939.
										(912.1	(876.1	36.1	(20697.89)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	23476.	14384.	4796.	2537.	730521.
CMS	665.	407.	136.	72.	20686.
INCHES		24.24	32.39	34.20	34.20
MM		615.69	821.19	868.59	868.59
AC-FT		7132.	9513.	10062.	10062.
THOUS CU M		8798.	11734.	12412.	12412.

159.	155.	152.	149.	155.	178.	225.	289.	359.	427.
490.	547.	600.	651.	698.	741.	781.	816.	847.	874.
896.	915.	931.	945.	957.	968.	977.	984.	991.	997.
1002.	1007.	1011.	1015.	1018.	1021.	1023.	1025.	1027.	1029.
1068.	1189.	1427.	1740.	2080.	2414.	2720.	2999.	3261.	3509.
3740.	3954.	4148.	4323.	4476.	4608.	4720.	4816.	4897.	4967.
5028.	5080.	5125.	5166.	5201.	5231.	5258.	5282.	5303.	5321.
5337.	5352.	5365.	5376.	5387.	5396.	5536.	5964.	6805.	7912.
9110.	10288.	11403.	12499.	13650.	14823.	15958.	17027.	18052.	19099.
20223.	21369.	22467.	23477.	24352.	25242.	26673.	30358.	36470.	43705.
48664.	50666.	50500.	49015.	47446.	46285.	45187.	43857.	42306.	40512.
38617.	36674.	34629.	32928.	29614.	26795.	23993.	21388.	19414.	17705.
16025.	14401.	12864.	11441.	10190.	8986.	7962.	7067.	6298.	5638.
5099.	4660.	4272.	3925.	3630.	3387.	3160.	2948.	2751.	2567.
2422.	2300.	2186.	2080.	1980.	1922.	1881.	1845.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	50666.	31129.	10560.	5595.	1611236.
CMS	1435.	881.	299.	158.	45629.
INCHES		14.41	19.56	20.72	20.72
MM		366.11	496.80	526.38	526.38
AC-FT		15436.	20946.	22193.	22193.
THOUS CU M		19040.	25837.	27375.	27375.

SUM OF 4 HYDROGRAPHS AT COMB PLAN 1 RTIO 4

82.	77.	74.	71.	68.	65.	63.	60.	57.	55.
52.	50.	47.	45.	43.	41.	39.	38.	36.	34.
33.	32.	30.	29.	28.	27.	26.	25.	24.	24.
23.	22.	22.	21.	21.	20.	20.	23.	28.	35.
42.	48.	53.	56.	58.	60.	61.	62.	63.	63.
64.	64.	64.	65.	66.	67.	70.	73.	77.	82.
88.	94.	101.	109.	116.	125.	133.	142.	151.	160.
169.	178.	196.	231.	295.	379.	472.	568.	664.	764.

874.	991.	1111.	1230.	1351.	1480.	1624.	1777.	1930.	2080.
2218.	2362.	2575.	3070.	3876.	4834.	5515.	5826.	5862.	5729.
5584.	5490.	5403.	5286.	5138.	4956.	4758.	4552.	4327.	4063.
3737.	3385.	3042.	2716.	2447.	2238.	2030.	1828.	1635.	1456.
1293.	1146.	1016.	903.	805.	722.	651.	591.	542.	499.
460.	425.	397.	370.	346.	327.	311.	295.	281.	272.
265.	259.	253.	249.	258.	296.	375.	482.	598.	712.
816.	911.	1001.	1085.	1163.	1236.	1301.	1360.	1412.	1456.
1494.	1525.	1552.	1576.	1596.	1613.	1628.	1641.	1652.	1662.
1671.	1678.	1685.	1691.	1696.	1701.	1705.	1709.	1712.	1716.
1781.	1982.	2378.	2900.	3466.	4023.	4533.	4998.	5436.	5849.
6234.	6590.	6914.	7205.	7459.	7679.	7867.	8026.	8161.	8279.
8379.	8466.	8542.	8609.	8668.	8719.	8763.	8803.	8838.	8868.
8896.	8920.	8941.	8960.	8978.	8993.	9227.	9940.	11341.	13186.
15183.	17147.	19004.	20832.	22751.	24705.	26597.	28378.	30087.	31831.
33705.	35615.	37444.	39128.	40586.	42069.	44455.	50597.	60783.	72841.
81106.	84444.	84166.	81692.	79076.	77141.	75312.	73095.	70510.	67520.
64362.	61124.	57716.	53881.	49357.	44591.	39988.	35647.	32357.	29508.
26708.	24002.	21440.	19069.	16916.	14976.	13270.	11779.	10497.	9397.
8499.	7767.	7120.	6541.	6050.	5645.	5267.	4914.	4585.	4278.
4037.	3833.	3643.	3466.	3300.	3204.	3135.	3076.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	84444.	51882.	17601.	9324.	2685393.
CMS	2391.	1469.	498.	264.	76042.
INCHES		24.02	32.60	34.54	34.54
MM		610.19	828.01	877.31	877.31
AC-FT		25727.	34910.	36989.	36989.
THOUS CU M		31734.	43061.	45625.	45625.

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HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR + OVER SPILLWAY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	2	2	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1261.	-1

STAGE	1261.00	1261.01	1261.05	1261.10	1261.20	1261.50	1262.00	1262.50	1263.00
1264.00									
	1265.00	1266.00	1267.00	1268.00	1269.00	1270.00	1271.00	1272.00	1273.00
1275.00									
FLOW	0.00	2.40	27.00	76.00	216.00	854.00	2415.00	4437.00	6831.00
12550.00									
	19320.00	26500.00	32000.00	36000.00	41000.00	45000.00	48200.00	53200.00	56800.00
64000.00									
SURFACE AREA=	0.	17.	91.	120.	221.	314.	412.	504.	624.	751.
	904.	1212.							
CAPACITY=	0.	57.	381.	1212.	2892.	5553.	9172.	13744.	19374.	26239.
	34502.	45045.							
ELEVATION=	1170.	1180.	1190.	1200.	1210.	1220.	1230.	1240.	1250.	1260.
	1270.	1280.							

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
1261.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID

OVN

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HYDROGRAPH ROUTING

CHANNEL ROUTING - MOD PULS REACH 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

B-1S

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1155.0	1170.0	4000.	.00380

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1170.00 400.00 1160.00 893.00 1156.00 895.00 1155.00 905.00 1155.00
907.00 1156.00 1200.00 1160.00 1700.00 1170.00

STORAGE	0.00	.84	4.87	19.76	45.89	83.27	131.89	190.41	254.41
323.57									
	397.88	477.33	561.94	651.70	746.62	846.68	951.89	1062.26	1177.77

1298.44

OUTFLOW	0.00	12.93	68.04	314.11	895.01	1925.16	3505.29	5896.44	9014.54
12774.15									
	17188.90	22276.17	28055.55	34547.90	41774.89	49758.66	58521.60	68086.21	78475.02
89710.52									
STAGE	1155.00	1155.79	1156.58	1157.37	1158.16	1158.95	1159.74	1160.53	1161.32
1162.11									
	1162.89	1163.68	1164.47	1165.26	1166.05	1166.84	1167.63	1168.42	1169.21
1170.00									
FLOW	0.00	12.93	68.04	314.11	895.01	1925.16	3505.29	5896.44	9014.54
12774.15									
	17188.90	22276.17	28055.55	34547.90	41774.89	49758.66	58521.60	68086.21	78475.02
89710.52									

STATION 1, PLAN 1, RTIO 1

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	2.	2.
3.	3.	4.	5.	5.	6.	7.	8.	10.	11.
13.	14.	16.	18.	20.	23.	27.	31.	37.	43.
50.	57.	66.	76.	86.	96.	106.	116.	125.	134.
142.	149.	156.	162.	167.	172.	175.	178.	181.	183.
184.	184.	184.	184.	183.	182.	181.	179.	177.	175.
173.	171.	168.	166.	163.	160.	157.	155.	152.	149.
146.	144.	141.	138.	135.	133.	130.	128.	125.	123.
121.	120.	118.	117.	116.	115.	115.	114.	114.	114.

1160.2	1160.3	1160.4	1160.4	1160.5	1160.6	1160.6	1160.7	1160.7	1160.8
1160.8	1160.9	1160.9	1160.9	1161.0	1161.0	1161.0	1161.1	1161.1	1161.2
1161.2	1161.4	1161.5	1161.6	1161.8	1162.0	1162.2	1162.5	1162.7	1162.9
1163.2	1163.4	1163.7	1163.9	1164.1	1164.3	1164.5	1164.7	1164.8	1165.1
1165.3	1165.7	1166.0	1166.2	1166.5	1166.6	1166.8	1167.0	1167.1	1167.2
1167.3	1167.3	1167.4	1167.4	1167.4	1167.4	1167.3	1167.3	1167.2	1167.1
1166.9	1166.8	1166.6	1166.5	1166.4	1166.2	1166.1	1165.9	1165.7	1165.5
1165.3	1165.1	1164.9	1164.6	1164.4	1164.1	1163.8	1163.5	1163.3	1163.0
1162.8	1162.6	1162.3	1162.2	1162.0	1161.8	1161.7	1161.5		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	55661.	45489.	16771.	8785.	2530081.
CMS	1576.	1288.	475.	249.	71644.
INCHES		21.06	31.06	32.54	32.54
MM		535.00	788.98	826.57	826.57
AC-FT		22557.	33265.	34850.	34850.
THOUS CU M		27823.	41032.	42986.	42986.

MAXIMUM STORAGE = 918.

MAXIMUM STAGE IS 1167.4

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HYDROGRAPH ROUTING

CHANNEL ROUTING - MOD PULS REACH 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1131.0	1150.0	6000.	.00400

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1150.00 390.00 1140.00 443.00 1132.00 445.00 1131.00 455.00 1131.00
457.00 1132.00 550.00 1140.00 750.00 1150.00

STORAGE	0.00	1.65	5.18	11.91	21.85	34.99	51.33	70.87	93.61
119.56	150.90	189.81	236.29	290.36	352.00	421.21	498.00	582.37	674.31
773.83									
OUTFLOW	0.00	19.96	83.89	221.33	459.64	822.12	1329.92	2002.64	2858.76
3915.85	4940.57	6347.83	8156.49	10399.50	13113.83	16337.27	20107.29	24469.66	29433.31
35060.31									
STAGE	1131.00	1132.00	1133.00	1134.00	1135.00	1136.00	1137.00	1138.00	1139.00
1140.00	1141.00	1142.00	1143.00	1144.00	1145.00	1146.00	1147.00	1148.00	1149.00
1150.00									
FLOW	0.00	19.96	83.89	221.33	459.64	822.12	1329.92	2002.64	2858.76

MAXIMUM STAGE IS 1153.6

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HYDROGRAPH ROUTING

CHANNEL ROUTING - MUD PULS REACH 3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

B-22

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1122.0	1140.0	6000.	.00150

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1140.00 350.00 1130.00 493.00 1123.00 495.00 1122.00 505.00 1122.00
507.00 1123.00 675.00 1130.00 850.00 1140.00

STORAGE	0.00	1.55	5.83	15.59	30.84	51.59	77.82	109.55	146.78

189.65									
	238.91	294.66	356.90	425.63	500.85	582.56	670.76	765.46	866.64
974.31									
OUTFLOW	0.00	11.13	50.24	151.29	343.93	652.93	1100.47	1707.01	2491.75
3454.27									
	4631.64	6060.14	7757.66	9742.42	12032.45	14645.49	17598.92	20909.77	24594.68
28669.97									
STAGE	1122.00	1122.95	1123.89	1124.84	1125.79	1126.74	1127.68	1128.63	1129.58
1130.53									
	1131.47	1132.42	1133.37	1134.32	1135.26	1136.21	1137.16	1138.11	1139.05
1140.00									
FLOW	0.00	11.13	50.24	151.29	343.93	652.93	1100.47	1707.01	2491.75
3454.27									
	4631.64	6060.14	7757.66	9742.42	12032.45	14645.49	17598.92	20909.77	24594.68
28669.97									

STATION 3, PLAN 1, RTIO 1

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	2.	2.	2.	2.	2.	3.
3.	3.	4.	4.	5.	6.	7.	7.	8.	10.
11.	14.	17.	20.	23.	28.	32.	37.	43.	49.
56.	64.	72.	80.	87.	95.	103.	110.	117.	124.
130.	136.	141.	146.	151.	155.	159.	163.	166.	168.
170.	171.	172.	172.	172.	172.	171.	170.	169.	167.

1128.0	1128.0	1128.1	1128.1	1128.1	1128.2	1128.2	1128.3	1128.3	1128.4
1128.5	1128.7	1128.8	1129.0	1129.2	1129.4	1129.6	1129.8	1130.1	1130.3
1130.5	1130.8	1131.0	1131.2	1131.4	1131.6	1131.8	1131.9	1132.1	1132.3
1132.4	1132.5	1132.7	1132.8	1132.9	1133.0	1133.1	1133.2	1133.2	1133.3
1133.4	1133.5	1133.6	1133.8	1134.0	1134.2	1134.5	1134.8	1135.2	1135.6
1136.0	1136.4	1136.9	1137.3	1137.8	1138.2	1138.6	1139.0	1139.4	1139.8
1140.1	1140.6	1141.1	1141.6	1142.2	1142.7	1143.3	1143.8	1144.2	1144.7
1145.0	1145.4	1145.6	1145.8	1146.0	1146.1	1146.1	1146.1	1146.1	1146.0
1145.8	1145.6	1145.4	1145.1	1144.8	1144.5	1144.2	1143.9	1143.5	1143.1
1142.7	1142.3	1141.9	1141.5	1141.1	1140.6	1140.2	1139.8	1139.3	1138.9
1138.4	1138.0	1137.6	1137.2	1136.8	1136.4	1136.0	1135.7		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	55102.	45234.	16422.	8572.	2468657.
CMS	1560.	1281.	465.	243.	69905.
INCHES		20.94	30.41	31.75	31.75
MM		532.00	772.54	806.50	806.50
AC-FT		22430.	32572.	34004.	34004.
THOUS CU M		27667.	40177.	41943.	41943.

MAXIMUM STORAGE = 1673.

MAXIMUM STAGE IS 1146.1

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SUB-AREA RUNOFF COMPUTATION

INFLOW (SUB-AREA)

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO

A 0 0 0 0 0 1 0 0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	IRSDA	IRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	18.90	0.00	39.00	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	26.50	95.00	113.00	123.00	133.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-83.00	0.00	0.00

CURVE NO = -83.00 WETNESS = -1.00 EFFECT CN = 83.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 2.22

RECESSION DATA
STRTQ= -1.50 QRCSN= -.10 RTIOR= 2.00

UNIT HYDROGRAPH 69 END OF PERIOD ORDINATES: TC= 0.00 HOURS: LAG= 2.22 VOL= 1.00

86.	243.	457.	715.	1047.	1445.	1911.	2456.	2940.	3352.
3667.	3847.	3938.	3957.	3928.	3785.	3601.	3399.	3170.	2903.
2601.	2257.	1964.	1721.	1524.	1352.	1201.	1072.	967.	862.
769.	683.	597.	535.	477.	421.	378.	335.	295.	264.
232.	206.	185.	163.	146.	130.	115.	103.	92.	81.
72.	64.	57.	51.	45.	41.	38.	34.	31.	27.
24.	20.	17.	15.	12.	9.	6.	3.	0.	

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.10	1	.00	0.00	.00	26.	1.02	.10	145	.03	.02	.01	298.
1.01	.20	2	.00	0.00	.00	25.	1.02	.20	146	.03	.02	.01	292.

1.01	.30	3	.00	0.00	.00	23.	1.02	.30	147	.03	.02	.01	292.
1.01	.40	4	.00	0.00	.00	21.	1.02	.40	148	.03	.02	.01	298.
1.01	.50	5	.00	0.00	.00	20.	1.02	.50	149	.03	.02	.01	312.
1.01	1.00	6	.00	0.00	.00	19.	1.02	1.00	150	.03	.02	.01	335.
1.01	1.10	7	.00	0.00	.00	17.	1.02	1.10	151	.03	.02	.01	368.
1.01	1.20	8	.00	0.00	.00	16.	1.02	1.20	152	.03	.02	.01	412.
1.01	1.30	9	.00	0.00	.00	15.	1.02	1.30	153	.03	.02	.01	467.
1.01	1.40	10	.00	0.00	.00	14.	1.02	1.40	154	.03	.02	.01	531.
1.01	1.50	11	.00	0.00	.00	13.	1.02	1.50	155	.03	.02	.01	601.
1.01	2.00	12	.00	0.00	.00	12.	1.02	2.00	156	.03	.02	.01	676.
1.01	2.10	13	.00	0.00	.00	12.	1.02	2.10	157	.03	.02	.01	754.
1.01	2.20	14	.00	0.00	.00	11.	1.02	2.20	158	.03	.02	.01	832.
1.01	2.30	15	.00	0.00	.00	10.	1.02	2.30	159	.03	.02	.01	911.
1.01	2.40	16	.00	0.00	.00	9.	1.02	2.40	160	.03	.02	.01	987.
1.01	2.50	17	.00	0.00	.00	9.	1.02	2.50	161	.03	.02	.01	1059.
1.01	3.00	18	.00	0.00	.00	8.	1.02	3.00	162	.03	.02	.01	1129.
1.01	3.10	19	.00	0.00	.00	8.	1.02	3.10	163	.03	.02	.01	1194.
1.01	3.20	20	.00	0.00	.00	7.	1.02	3.20	164	.03	.02	.01	1255.
1.01	3.30	21	.00	0.00	.00	7.	1.02	3.30	165	.03	.02	.01	1310.
1.01	3.40	22	.00	0.00	.00	6.	1.02	3.40	166	.03	.02	.01	1359.
1.01	3.50	23	.00	0.00	.00	6.	1.02	3.50	167	.03	.02	.01	1401.
1.01	4.00	24	.00	0.00	.00	5.	1.02	4.00	168	.03	.02	.00	1439.
1.01	4.10	25	.00	0.00	.00	5.	1.02	4.10	169	.03	.02	.00	1474.
1.01	4.20	26	.00	0.00	.00	5.	1.02	4.20	170	.03	.02	.00	1505.
1.01	4.30	27	.00	0.00	.00	4.	1.02	4.30	171	.03	.02	.00	1533.
1.01	4.40	28	.00	0.00	.00	4.	1.02	4.40	172	.03	.02	.00	1559.
1.01	4.50	29	.00	0.00	.00	4.	1.02	4.50	173	.03	.02	.00	1582.
1.01	5.00	30	.00	0.00	.00	4.	1.02	5.00	174	.03	.02	.00	1604.
1.01	5.10	31	.00	0.00	.00	3.	1.02	5.10	175	.03	.02	.00	1624.
1.01	5.20	32	.00	0.00	.00	3.	1.02	5.20	176	.03	.02	.00	1642.
1.01	5.30	33	.00	0.00	.00	3.	1.02	5.30	177	.03	.02	.00	1658.
1.01	5.40	34	.00	0.00	.00	3.	1.02	5.40	178	.03	.03	.00	1674.
1.01	5.50	35	.00	0.00	.00	3.	1.02	5.50	179	.03	.03	.00	1688.
1.01	6.00	36	.00	0.00	.00	2.	1.02	6.00	180	.03	.03	.00	1700.
1.01	6.10	37	.01	0.00	.01	2.	1.02	6.10	181	.13	.11	.02	1720.
1.01	6.20	38	.01	0.00	.01	2.	1.02	6.20	182	.13	.11	.02	1753.

1.01	6.30	39	.01	0.00	.01	2.	1.02	6.30	183	.13	.12	.02	1803.
1.01	6.40	40	.01	0.00	.01	2.	1.02	6.40	184	.13	.12	.02	1877.
1.01	6.50	41	.01	0.00	.01	2.	1.02	6.50	185	.13	.12	.02	1979.
1.01	7.00	42	.01	0.00	.01	2.	1.02	7.00	186	.13	.12	.02	2117.
1.01	7.10	43	.01	0.00	.01	1.	1.02	7.10	187	.13	.12	.01	2297.
1.01	7.20	44	.01	0.00	.01	1.	1.02	7.20	188	.13	.12	.01	2526.
1.01	7.30	45	.01	0.00	.01	1.	1.02	7.30	189	.13	.12	.01	2799.
1.01	7.40	46	.01	0.00	.01	1.	1.02	7.40	190	.13	.12	.01	3110.
1.01	7.50	47	.01	0.00	.01	1.	1.02	7.50	191	.13	.12	.01	3451.
1.01	8.00	48	.01	0.00	.01	1.	1.02	8.00	192	.13	.12	.01	3810.
1.01	8.10	49	.01	0.00	.01	1.	1.02	8.10	193	.13	.12	.01	4179.
1.01	8.20	50	.01	0.00	.01	1.	1.02	8.20	194	.13	.12	.01	4552.
1.01	8.30	51	.01	0.00	.01	1.	1.02	8.30	195	.13	.12	.01	4924.
1.01	8.40	52	.01	0.00	.01	1.	1.02	8.40	196	.13	.12	.01	5285.
1.01	8.50	53	.01	0.00	.01	1.	1.02	8.50	197	.13	.12	.01	5631.
1.01	9.00	54	.01	0.00	.01	1.	1.02	9.00	198	.13	.12	.01	5961.
1.01	9.10	55	.01	0.00	.01	1.	1.02	9.10	199	.13	.12	.01	6272.
1.01	9.20	56	.01	0.00	.01	1.	1.02	9.20	200	.13	.12	.01	6560.
1.01	9.30	57	.01	0.00	.01	1.	1.02	9.30	201	.13	.12	.01	6822.
1.01	9.40	58	.01	0.00	.01	1.	1.02	9.40	202	.13	.12	.01	7054.
1.01	9.50	59	.01	0.00	.01	0.	1.02	9.50	203	.13	.12	.01	7260.
1.01	10.00	60	.01	0.00	.01	0.	1.02	10.00	204	.13	.12	.01	7444.
1.01	10.10	61	.01	0.00	.01	0.	1.02	10.10	205	.13	.12	.01	7610.
1.01	10.20	62	.01	0.00	.01	0.	1.02	10.20	206	.13	.13	.01	7760.
1.01	10.30	63	.01	0.00	.01	0.	1.02	10.30	207	.13	.13	.01	7897.
1.01	10.40	64	.01	0.00	.01	0.	1.02	10.40	208	.13	.13	.01	8021.
1.01	10.50	65	.01	0.00	.01	0.	1.02	10.50	209	.13	.13	.01	8135.
1.01	11.00	66	.01	0.00	.01	0.	1.02	11.00	210	.13	.13	.01	8239.
1.01	11.10	67	.01	.00	.01	0.	1.02	11.10	211	.13	.13	.01	8334.
1.01	11.20	68	.01	.00	.01	0.	1.02	11.20	212	.13	.13	.01	8421.
1.01	11.30	69	.01	.00	.01	0.	1.02	11.30	213	.13	.13	.01	8499.
1.01	11.40	70	.01	.00	.01	0.	1.02	11.40	214	.13	.13	.01	8571.
1.01	11.50	71	.01	.00	.01	1.	1.02	11.50	215	.13	.13	.01	
1.01	12.00	72	.01	.00	.01	1.	1.02	12.00	216	.13	.13	.01	8697.
1.01	12.10	73	.03	.00	.03	2.	1.02	12.10	217	.42	.40	0	8776.
1.01	12.20	74	.03	.00	.03	3.	1.02	12.20	218	.42	0	.02	8894.

1.01	12.30	75	.03	.00	.03	5.	1.02	12.30	219		.61	.01	8067.
1.01	12.40	76	.03	.01	.03	9.	1.02	12.40	220		.41	.01	9308.
1.01	12.50	77	.03	.01	.03	14.	1.02	12.50	221	2	.41	.01	9637.
1.01	13.00	78	.03	.01	.03	21.	1.02	13.00	222	2	.41	.01	10075.
1.01	13.10	79	.04	.01	.03	30.	1.02	13.10	223		.49	.01	10647.
1.01	13.20	80	.04	.01	.03	43.	1.02	13.20	224	0	.49	.01	11381.
1.01	13.30	81	.04	.01	.03	59.	1.02	13.30	225	0	.49	.01	12267.
1.01	13.40	82	.04	.01	.03	80.	1.02	13.40	226	.5	.49	.01	13288.
1.01	13.50	83	.04	.01	.03	105.	1.02	13.50	227	.50	.49	.01	14423.
1.01	14.00	84	.04	.01	.03	134.	1.02	14.00	228	.50		.01	15643.
1.01	14.10	85	.05	.02	.03	167.	1.02	14.10	229	.63	.62	.01	16937.
1.01	14.20	86	.05	.02	.03	206.	1.02	14.20	230	.63	.62		18303.
1.01	14.30	87	.05	.02	.03	250.	1.02	14.30	231	.63	.62	.01	19727.
1.01	14.40	88	.05	.02	.03	299.	1.02	14.40	232	.63	.62	.01	2 0.
1.01	14.50	89	.05	.02	.03	353.	1.02	14.50	233	.63	.62	.01	2265
1.01	15.00	90	.05	.02	.03	412.	1.02	15.00	234	.63	.62	.01	24129.
1.01	15.10	91	.05	.02	.02	475.	1.02	15.10	235	.57	.57	.01	25606.
1.01	15.20	92	.08	.04	.04	544.	1.02	15.20	236	.96	.95	.01	27104.
1.01	15.30	93	.14	.08	.06	623.	1.02	15.30	237	1.72	1.71	.02	28689.
1.01	15.40	94	.35	.22	.13	725.	1.02	15.40	238	4.30	4.28	.03	30625.
1.01	15.50	95	.10	.07	.03	850.	1.02	15.50	239	1.24	1.24	.01	32888.
1.01	16.00	96	.06	.04	.02	994.	1.02	16.00	240	.77	.76	.00	35422.
1.01	16.10	97	.05	.03	.01	1155.	1.02	16.10	241	.59	.58	.00	38192.
1.01	16.20	98	.05	.03	.01	1338.	1.02	16.20	242	.59	.58	.00	41280.
1.01	16.30	99	.05	.03	.01	1542.	1.02	16.30	243	.59	.58	.00	44686.
1.01	16.40	100	.05	.03	.01	1765.	1.02	16.40	244	.59	.58	.00	48367.
1.01	16.50	101	.05	.03	.01	2003.	1.02	16.50	245	.59	.58	.00	52211.
1.01	17.00	102	.05	.03	.01	2227.	1.02	17.00	246	.59	.59	.00	55697.
1.01	17.10	103	.04	.03	.01	2429.	1.02	17.10	247	.46	.46	.00	58649.
1.01	17.20	104	.04	.03	.01	2599.	1.02	17.20	248	.46	.46	.00	60909.
1.01	17.30	105	.04	.03	.01	2730.	1.02	17.30	249	.46	.46	.00	62368.
1.01	17.40	106	.04	.03	.01	2831.	1.02	17.40	250	.46	.46	.00	63198.
1.01	17.50	107	.04	.03	.01	2903.	1.02	17.50	251	.46	.46	.00	63485.
1.01	18.00	108	.04	.03	.01	2951.	1.02	18.00	252	.46	.46	.00	63294.
1.01	18.10	109	.00	.00	.00	2963.	1.02	18.10	253	.04	.04	.00	62454.
1.01	18.20	110	.00	.00	.00	2950.	1.02	18.20	254	.04	.04	.00	61185.

1.01	18.30	111	.00	.00	.00	2916.	1.02	18.30	255	.04	.04	.00	59584.
1.01	18.40	112	.00	.00	.00	2861.	1.02	18.40	256	.04	.04	.00	57631.
1.01	18.50	113	.00	.00	.00	2780.	1.02	18.50	257	.04	.04	.00	55269.
1.01	19.00	114	.00	.00	.00	2673.	1.02	19.00	258	.04	.04	.00	52513.
1.01	19.10	115	.00	.00	.00	2544.	1.02	19.10	259	.04	.04	.00	49427.
1.01	19.20	116	.00	.00	.00	2408.	1.02	19.20	260	.04	.04	.00	46324.
1.01	19.30	117	.00	.00	.00	2269.	1.02	19.30	261	.04	.04	.00	43280.
1.01	19.40	118	.00	.00	.00	2129.	1.02	19.40	262	.04	.04	.00	40320.
1.01	19.50	119	.00	.00	.00	1988.	1.02	19.50	263	.04	.04	.00	37403.
1.01	20.00	120	.00	.00	.00	1847.	1.02	20.00	264	.04	.04	.00	34564.
1.01	20.10	121	.00	.00	.00	1709.	1.02	20.10	265	.04	.04	.00	31833.
1.01	20.20	122	.00	.00	.00	1576.	1.02	20.20	266	.04	.04	.00	29232.
1.01	20.30	123	.00	.00	.00	1446.	1.02	20.30	267	.04	.04	.00	26711.
1.01	20.40	124	.00	.00	.00	1322.	1.02	20.40	268	.04	.04	.00	24341.
1.01	20.50	125	.00	.00	.00	1206.	1.02	20.50	269	.04	.04	.00	22121.
1.01	21.00	126	.00	.00	.00	1096.	1.02	21.00	270	.04	.04	.00	20047.
1.01	21.10	127	.00	.00	.00	997.	1.02	21.10	271	.04	.04	.00	18185.
1.01	21.20	128	.00	.00	.00	906.	1.02	21.20	272	.04	.04	.00	16490.
1.01	21.30	129	.00	.00	.00	825.	1.02	21.30	273	.04	.04	.00	14964.
1.01	21.40	130	.00	.00	.00	755.	1.02	21.40	274	.04	.04	.00	13646.
1.01	21.50	131	.00	.00	.00	692.	1.02	21.50	275	.04	.04	.00	12476.
1.01	22.00	132	.00	.00	.00	638.	1.02	22.00	276	.04	.04	.00	11443.
1.01	22.10	133	.00	.00	.00	589.	1.02	22.10	277	.04	.04	.00	10535.
1.01	22.20	134	.00	.00	.00	546.	1.02	22.20	278	.04	.04	.00	9720.
1.01	22.30	135	.00	.00	.00	508.	1.02	22.30	279	.04	.04	.00	9004.
1.01	22.40	136	.00	.00	.00	475.	1.02	22.40	280	.04	.04	.00	8370.
1.01	22.50	137	.00	.00	.00	444.	1.02	22.50	281	.04	.04	.00	7795.
1.01	23.00	138	.00	.00	.00	417.	1.02	23.00	282	.04	.04	.00	7288.
1.01	23.10	139	.00	.00	.00	393.	1.02	23.10	283	.04	.04	.00	6832.
1.01	23.20	140	.00	.00	.00	372.	1.02	23.20	284	.04	.04	.00	6423.
1.01	23.30	141	.00	.00	.00	353.	1.02	23.30	285	.04	.04	.00	6070.
1.01	23.40	142	.00	.00	.00	336.	1.02	23.40	286	.04	.04	.00	5750.
1.01	23.50	143	.00	.00	.00	321.	1.02	23.50	287	.04	.04	.00	5464.
1.02	0.00	144	.00	.00	.00	308.	1.03	0.00	288	.04	.04	.00	5213.
									SUM	35.24	32.90	2.34	2338497.

1279.	1317.	1353.	1389.	1422.	1452.	1480.	1507.	1532.	1556.
1579.	1602.	1624.	1645.	1666.	1685.	1704.	1722.	1740.	1756.
1777.	1806.	1845.	1898.	1970.	2064.	2186.	2341.	2529.	2746.
2989.	3251.	3527.	3814.	4116.	4422.	4726.	5028.	5325.	5616.
5909.	6190.	6459.	6716.	6963.	7204.	7440.	7665.	7879.	8084.
8278.	8463.	8640.	8805.	8955.	9094.	9238.	9400.	9593.	9826.
10117.	10484.	10951.	11552.	12288.	13155.	14148.	15258.	16495.	17860.
19305.	20853.	22474.	24145.	25898.	27708.	29625.	31803.	34203.	36872.
39818.	43192.	47020.	51234.	55633.	59803.	63468.	66468.	68728.	70375.
71488.	72131.	72216.	71888.	71212.	70181.	68763.	66965.	64831.	62553.
60181.	57721.	55140.	52463.	49735.	46982.	44166.	41338.	38541.	35834.
33271.	30834.	28587.	26508.	24591.	22840.	21228.	19779.	18460.	17243.
16141.	15133.	14197.	13339.	12567.	11848.	11183.	10587.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	72216.	53782.	19181.	9955.	2867033.
CMS	2045.	1523.	543.	282.	81185.
INCHES		12.83	18.30	19.00	19.00
MM		325.92	464.94	482.62	482.62
AC-FT		26669.	38044.	39491.	39491.
THOUS CU M		32896.	46927.	48711.	48711.

SUM OF 2 HYDROGRAPHS AT 5 PLAN 1 RTIO 4

26.	25.	23.	21.	20.	19.	18.	16.	15.	14.
13.	13.	12.	11.	11.	10.	10.	9.	9.	9.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	9.	9.	9.
9.	9.	9.	9.	9.	10.	10.	10.	10.	10.
10.	11.	11.	11.	11.	12.	12.	12.	13.	13.
13.	14.	14.	15.	15.	15.	16.	16.	17.	18.
19.	20.	21.	23.	26.	31.	37.	45.	56.	71.
89.	112.	139.	171.	209.	253.	303.	361.	425.	496.
574.	660.	759.	888.	1048.	1231.	1437.	1673.	1949.	2261.

2602.	2956.	3310.	3645.	3965.	4267.	4544.	4807.	5031.	5216.
5367.	5486.	5560.	5586.	5566.	5516.	5440.	5341.	5221.	5081.
4928.	4764.	4588.	4407.	4223.	4039.	3859.	3684.	3515.	3356.
3205.	3065.	2933.	2807.	2689.	2578.	2471.	2371.	2274.	2181.
2094.	2012.	1935.	1861.	1792.	1729.	1674.	1626.	1588.	1562.
1548.	1549.	1565.	1597.	1639.	1689.	1746.	1808.	1874.	1942.
2011.	2080.	2149.	2217.	2282.	2343.	2400.	2455.	2507.	2558.
2606.	2653.	2700.	2745.	2789.	2830.	2869.	2907.	2943.	2977.
3018.	3071.	3142.	3236.	3359.	3521.	3729.	3994.	4311.	4678.
5089.	5537.	6022.	6532.	7061.	7599.	8141.	8698.	9249.	9786.
10300.	10795.	11263.	11709.	12137.	12559.	12967.	13352.	13717.	14061.
14386.	14705.	15000.	15275.	15530.	15767.	16010.	16281.	16600.	16985.
17476.	18110.	18930.	19985.	21276.	22801.	24572.	26560.	28752.	31172.
33763.	36505.	39366.	42322.	45363.	48452.	51649.	55145.	58975.	63077.
67500.	72425.	77935.	83962.	90264.	96164.	101397.	105800.	109271.	111951.
113872.	115063.	115349.	114962.	114014.	112496.	110357.	107615.	104330.	100804.
97098.	93237.	89228.	85182.	81191.	77294.	73419.	69599.	65823.	62079.
58469.	55010.	51732.	48658.	45700.	42840.	40067.	37351.	34738.	32275.
29976.	27843.	25895.	24082.	22468.	20978.	19639.	18443.		

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	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	115349.	87835.	32076.	16682.	4804536.
CMS	3266.	2487.	908.	472.	136049.
INCHES		20.96	30.61	31.84	31.84
MM		532.28	777.52	808.76	808.76
AC-FT		43554.	63621.	66178.	
THOUS CU M		53723.	78476.	81630.	81630.

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HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR (MCDANIEL LAKE)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1123.	-1

STAGE	1123.00	1124.00	1125.00	1126.00	1127.00	1128.00	1128.70	1130.20	1131.00
1132.00									
	1134.00	1136.00	1138.00	1140.00	1150.00				
FLOW	0.00	192.00	543.00	1915.00	4131.00	7149.00	9664.00	22863.00	25933.00
30520.00									
	41109.00	53145.00	66397.00	80734.00	166186.00				
SURFACE AREA=	0.	226.	331.	404.	493.				
CAPACITY=	0.	3541.	5479.	9147.	13625.				
ELEVATION=	1076.	1123.	1130.	1140.	1150.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1123.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1128.7	3.0	1.5	1110.

CREST LENGTH AT OR BELOW ELEVATION	768.	771.	784.	897.	1110.
	1128.7	1129.0	1130.0	1140.0	1150.0

STATION 5, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	2.	3.
3.	4.	5.	5.	6.	7.	9.	10.	12.	14.
16.	18.	21.	24.	27.	30.	33.	37.	40.	44.
47.	50.	54.	57.	60.	64.	67.	70.	73.	75.
78.	80.	83.	85.	87.	89.	91.	93.	95.	96.
98.	100.	101.	103.	104.	105.	107.	108.	109.	110.
111.	112.	113.	114.	115.	116.	116.	117.	118.	118.
119.	120.	121.	121.	122.	123.	124.	125.	126.	127.
128.	129.	131.	132.	133.	134.	136.	137.	139.	140.
142.	143.	145.	146.	148.	149.	151.	152.	154.	155.
157.	158.	160.	161.	163.	165.	167.	169.	172.	175.
178.	181.	185.	189.	196.	205.	215.	225.	236.	248.
260.	272.	285.	298.	311.	325.	339.	353.	367.	382.
397.	412.	427.	442.	458.	473.	489.	505.	521.	538.
588.	653.	717.	783.	851.	922.	997.	1077.	1161.	1251.
1347.	1450.	1559.	1675.	1797.	1933.	2148.	2368.	2597.	2837.
3091.	3362.	3653.	3967.	4366.	4844.	5333.	5824.	6308.	6775.
7235.	7726.	8167.	8557.	8895.	9180.	9411.	9585.	9743.	9862.
9839.	9715.	9601.	9480.	9319.	9125.	8903.	8657.	8392.	8112.
7821.	7521.	7217.	6947.	6684.	6420.	6157.	5898.	5643.	5394.
5152.	4918.	4693.	4476.	4270.	4088.	3947.	3808.		

STORAGE

3541.	3541.	3541.	3541.	3541.	3541.	3541.	3541.	3541.	3541.

AC-FT	26496.	37133.	37893.	37893.	
THOUS CU M	32682.	45805.	46740.	46740.	

STATION 5, PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	1.	1.	1.	1.	2.	2.	2.	2.	2.
2.	2.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	7.
7.	7.	7.	7.	7.	8.	8.	8.	9.	9.
10.	11.	13.	14.	16.	19.	22.	25.	30.	35.
40.	47.	55.	63.	74.	86.	100.	116.	135.	157.
182.	226.	283.	346.	413.	483.	599.	889.	1173.	1448.
1712.	1995.	2372.	2711.	3012.	3276.	3504.	3699.	3862.	3994.
4097.	4188.	4254.	4288.	4291.	4269.	4226.	4164.	4098.	4030.
3954.	3870.	3780.	3687.	3590.	3491.	3391.	3290.	3189.	3089.
2989.	2891.	2795.	2700.	2608.	2518.	2432.	2349.	2270.	2196.
2127.	2062.	2011.	1965.	1927.	1909.	1892.	1884.	1881.	1883.
1890.	1900.	1915.	1943.	1976.	2012.	2051.	2091.	2133.	2175.
2219.	2263.	2307.	2351.	2395.	2439.	2483.	2526.	2568.	2609.
2650.	2692.	2736.	2783.	2838.	2901.	2977.	3069.	3183.	3319.
3481.	3671.	3888.	4132.	4495.	4879.	5281.	5700.	6133.	6579.
7032.	7548.	8075.	8586.	9087.	9571.	10558.	11507.	12265.	12881.
13396.	13840.	14284.	14887.	14907.	15199.	15472.	15739.	16010.	16327.
16689.	17133.	17694.	18411.	19319.	20440.	21789.	23370.	25181.	27225.
28786.	30712.	32963.	35560.	38449.	41460.	44577.	47974.	51550.	55333.
59361.	63707.	68473.	73836.	79718.	85765.	91656.	97109.	1019061.	106049.
109329.	111793.	113433.	114262.	114371.	113834.	112676.	110904.	108542.	105688.
102482.	99096.	95489.	91712.	87847.	83972.	80116.	76292.	72509.	68850.
65278.	61756.	58334.	55049.	51908.	48899.	45995.	43280.	40671.	38129.
35687.	33428.	31370.	29417.	27586.	25230.	23151.	21433.		

STORAGE

3541.	3541.	3542.	3542.	3542.	3543.	3543.	3543.	3543.	3543.
3543.	3544.	3544.	3544.	3544.	3544.	3544.	3544.	3544.	3544.
3545.	3545.	3545.	3545.	3545.	3545.	3545.	3545.	3545.	3545.
3545.	3545.	3545.	3545.	3545.	3545.	3545.	3546.	3546.	3546.
3546.	3546.	3546.	3546.	3546.	3546.	3546.	3546.	3546.	3546.
3546.	3546.	3547.	3547.	3547.	3547.	3547.	3547.	3547.	3547.
3547.	3547.	3548.	3548.	3548.	3548.	3548.	3548.	3548.	3548.
3549.	3549.	3549.	3549.	3549.	3550.	3550.	3550.	3551.	3552.
3553.	3554.	3556.	3558.	3560.	3563.	3566.	3571.	3576.	3582.

3588.	3596.	3605.	3616.	3628.	3643.	3660.	3680.	3703.	3730.
3761.	3797.	3836.	3880.	3927.	3978.	4031.	4085.	4138.	4191.
4242.	4291.	4337.	4379.	4416.	4449.	4478.	4503.	4523.	4540.
4553.	4563.	4569.	4572.	4573.	4571.	4567.	4561.	4553.	4545.
4535.	4524.	4513.	4501.	4489.	4476.	4464.	4451.	4438.	4426.
4414.	4401.	4389.	4378.	4366.	4355.	4345.	4334.	4325.	4316.
4307.	4300.	4293.	4288.	4283.	4280.	4277.	4276.	4275.	4275.
4277.	4279.	4282.	4285.	4289.	4293.	4298.	4303.	4308.	4313.
4319.	4324.	4329.	4335.	4340.	4346.	4351.	4356.	4361.	4366.
4372.	4377.	4382.	4388.	4395.	4403.	4412.	4424.	4438.	4455.
4475.	4499.	4527.	4558.	4592.	4628.	4667.	4707.	4749.	4793.
4837.	4882.	4926.	4970.	5012.	5054.	5091.	5120.	5143.	5161.
5176.	5189.	5200.	5210.	5219.	5227.	5235.	5242.	5250.	5258.
5268.	5281.	5296.	5315.	5339.	5369.	5405.	5446.	5492.	5544.
5605.	5680.	5764.	5854.	5948.	6044.	6141.	6239.	6340.	6444.
6553.	6670.	6795.	6930.	7072.	7216.	7355.	7482.	7592.	7684.
7756.	7809.	7845.	7863.	7865.	7854.	7829.	7790.	7738.	7676.
7608.	7528.	7444.	7356.	7265.	7174.	7082.	6989.	6897.	6805.
6711.	6618.	6526.	6436.	6350.	6265.	6183.	6101.	6019.	5938.
5858.	5781.	5704.	5630.	5558.	5494.	5440.	5395.		

STAGE

1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0	1123.0
1123.1	1123.1	1123.1	1123.1	1123.1	1123.1	1123.1	1123.1	1123.2	1123.2
1123.2	1123.2	1123.3	1123.3	1123.4	1123.4	1123.5	1123.6	1123.7	1123.8
1123.9	1124.1	1124.3	1124.4	1124.6	1124.8	1125.0	1125.3	1125.5	1125.7
1125.9	1126.0	1126.2	1126.4	1126.5	1126.6	1126.7	1126.8	1126.9	1126.9
1127.0	1127.0	1127.0	1127.1	1127.1	1127.0	1127.0	1127.0	1127.0	1127.0
1126.9	1126.9	1126.8	1126.8	1126.8	1126.7	1126.7	1126.6	1126.6	1126.5
1126.5	1126.4	1126.4	1126.4	1126.3	1126.3	1126.2	1126.2	1126.2	1126.1
1126.1	1126.1	1126.0	1126.0	1126.0	1126.0	1126.0	1126.0	1126.0	1126.0
1126.0	1126.0	1126.0	1126.0	1126.0	1126.0	1126.1	1126.1	1126.1	1126.1
1126.1	1126.2	1126.2	1126.2	1126.2	1126.2	1126.3	1126.3	1126.3	1126.3
1126.3	1126.4	1126.4	1126.4	1126.4	1126.4	1126.5	1126.5	1126.6	1126.6
1126.7	1126.8	1126.9	1127.0	1127.1	1127.2	1127.4	1127.5	1127.7	1127.8
1128.0	1128.1	1128.3	1128.4	1128.5	1128.7	1128.8	1128.9	1129.0	1129.0
1129.1	1129.1	1129.1	1129.2	1129.2	1129.2	1129.2	1129.3	1129.3	1129.3
1129.4	1129.4	1129.4	1129.5	1129.6	1129.7	1129.8	1129.9	1130.0	1130.2
1130.4	1130.6	1130.9	1131.1	1131.4	1131.7	1132.0	1132.2	1132.5	1132.8
1133.1	1133.5	1133.8	1134.2	1134.6	1135.0	1135.4	1135.7	1136.0	1136.2
1136.4	1136.6	1136.7	1136.7	1136.7	1136.7	1136.6	1136.5	1136.4	1136.2
1135.0	1135.8	[illegible]	1135.4	1135.1	1134.9	1134.6	1134.4	1134.1	1133.8
1133.6	1133.3	1133.1	1132.8	1132.6	1132.3	1132.1	1131.8	1131.6	1131.4

1131.1 1130.9 1130.7 1130.5 1130.2 1130.0 1129.9 1129.7

PEAK OUTFLOW IS 114371. AT TIME 42.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	114371.	87451.	31562.	16215.	4669853.
CMS	3239.	2476.	894.	459.	132236.
INCHES		20.86	30.12	30.95	30.95
MM		529.96	765.07	786.09	786.09
AC-FT		43364.	62603.	64323.	64323.
THOUS CU M		53489.	77220.	79341.	79341.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .50	RATIO 3 .60	RATIO 4 1.00
HYDROGRAPH AT	SOUTH	9.52	1	2348.	11738.	14086.	23476.
		(14.30)	(	66.48)(	332.39)(	398.87)(	664.78)(
HYDROGRAPH AT	NORTH	7.37	1	2927.	14634.	17561.	29269.
		(19.09)	(	82.88)(	414.40)(	497.28)(	828.79)(
HYDROGRAPH AT	LCL	3.60	1	2257.	11286.	13544.	22573.
		(9.32)	(	63.92)(	319.59)(	383.51)(	639.19)(
HYDROGRAPH AT	DIRCT	3.60	1	2280.	11402.	13682.	22803.
		(9.32)	(	64.57)(	322.86)(	387.43)(	645.72)(
4 COMBINED	COMB	20.09	1	8444.	42222.	50666.	84444.
		(52.03)	(	239.12)(	1195.59)(	1434.71)(	2391.18)(
ROUTED TO	DAM	20.09	1	5569.	31301.	36053.	55725.
		(52.03)	(	157.71)(	886.35)(	1020.90)(	1577.95)(
ROUTED TO	1	20.09	1	5520.	31228.	35991.	55661.
		(52.03)	(	156.31)(	884.29)(	1019.15)(	1576.14)(
ROUTED TO	2	20.09	1	5451.	31115.	35868.	55496.
		(52.03)	(	154.35)(	881.07)(	1015.68)(	1571.46)(
ROUTED TO	3	20.09	1	5318.	30816.	35602.	55102.
		(52.03)	(	150.60)(	872.62)(	1008.15)(	1560.32)(
HYDROGRAPH AT	4	18.90	1	6348.	31742.	38091.	63485.
		(48.95)	(	179.77)(	898.84)(	1078.61)(	1797.69)(
2 COMBINED	5	38.99	1	10828.	61367.	72216.	115349.
		(100.98)	(	306.62)(	1737.73)(	2044.93)(	3266.31)(
ROUTED TO	5	38.99	1	9862.	60497.	71363.	114371.
		(100.98)	(	279.26)(	1713.07)(	2020.78)(	3238.62)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ..... INITIAL VALUE SPILLWAY CREST TOP OF DAM

ELEVATION	1261.00	1261.00	1273.00
STORAGE	26997.	26997.	37345.
OUTFLOW	0.	0.	56800.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1262.74	0.00	28349.	5569.	0.00	42.33	0.00
.50	1266.87	0.00	31753.	31301.	0.00	42.00	0.00
.60	1268.01	0.00	32735.	36053.	0.00	42.00	0.00
1.00	1272.70	0.00	37050.	55725.	0.00	42.33	0.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	5520.	1160.4	42.50
.50	31228.	1164.9	42.17
.60	35991.	1165.4	42.17
1.00	55661.	1167.4	42.33

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	5451.	1141.4	42.83
.50	31115.	1149.3	42.33
.60	35860.	1150.1	42.50
1.00	55496.	1153.6	42.67

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	5318.	1131.9	43.33
.50	30816.	1140.5	42.67
.60	35602.	1141.6	42.67
1.00	55102.	1146.1	43.00

SUMMARY OF DAM SAFETY ANALYSIS

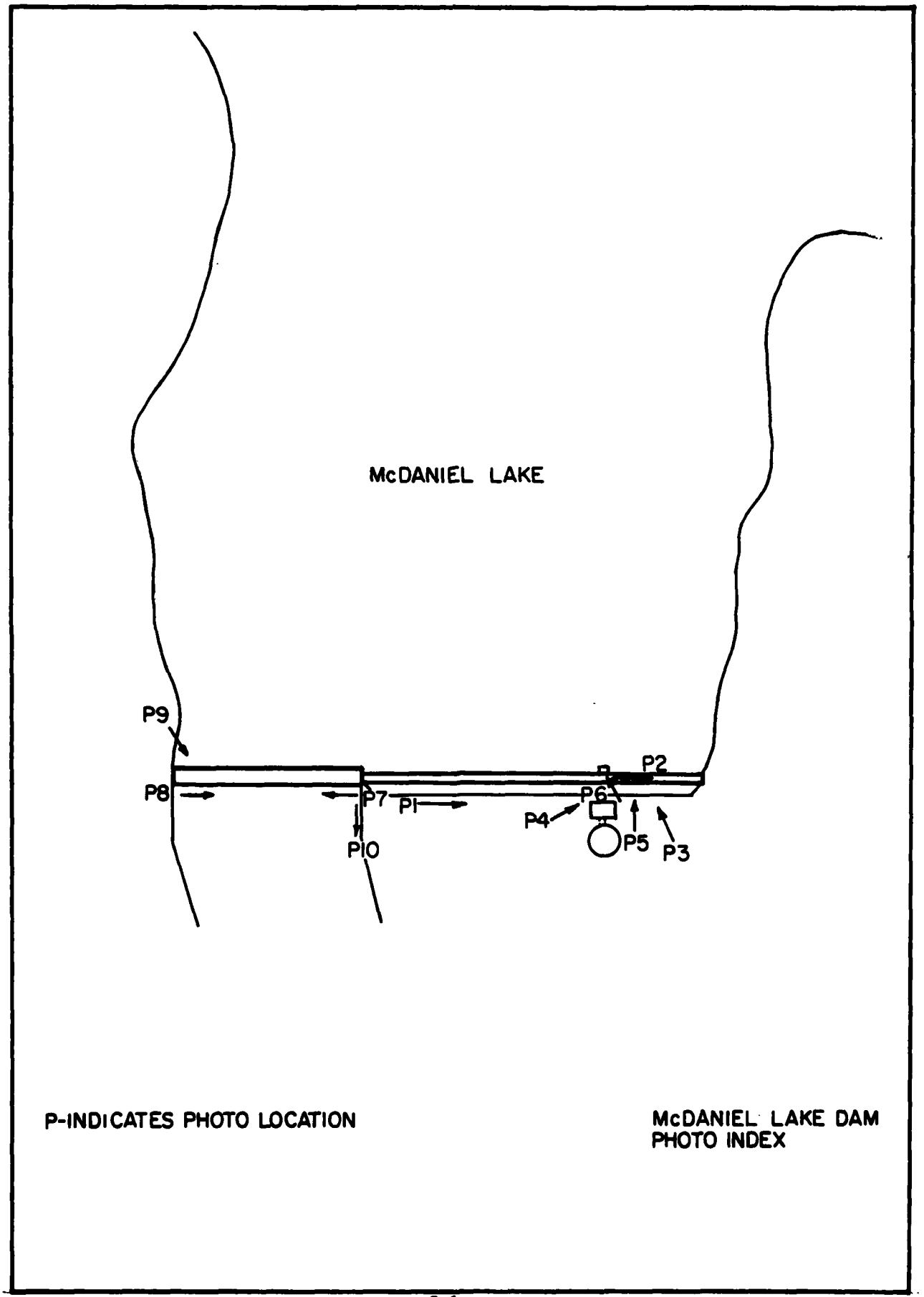
PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1123.00	1123.00	1128.70
STORAGE	3541.	3541.	5062.
OUTFLOW	0.	0.	9664.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1128.72	.02	5069.	9862.	.67	43.33	0.00
.50	1133.23	4.53	6584.	60497.	10.00	42.50	0.00
.60	1134.03	5.33	6869.	71363.	10.67	42.50	0.00
1.00	1136.73	8.03	7865.	114371.	13.67	42.50	0.00

APPENDIX C

PHOTOGRAPHS

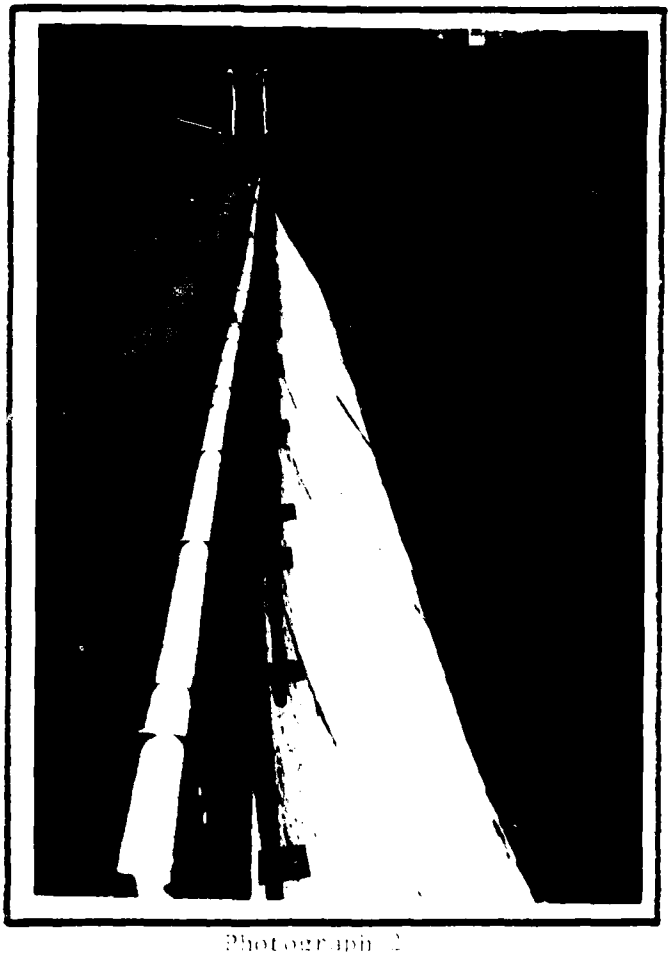


P-INDICATES PHOTO LOCATION

McDANIEL LAKE DAM
PHOTO INDEX

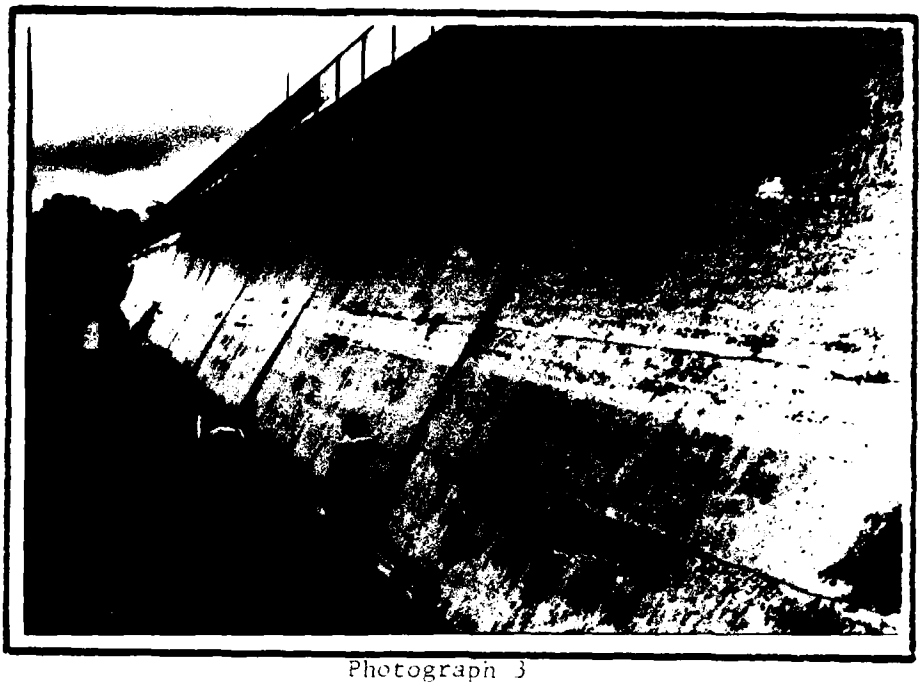
Photograph 1

Downstream slope of dam near right abutment



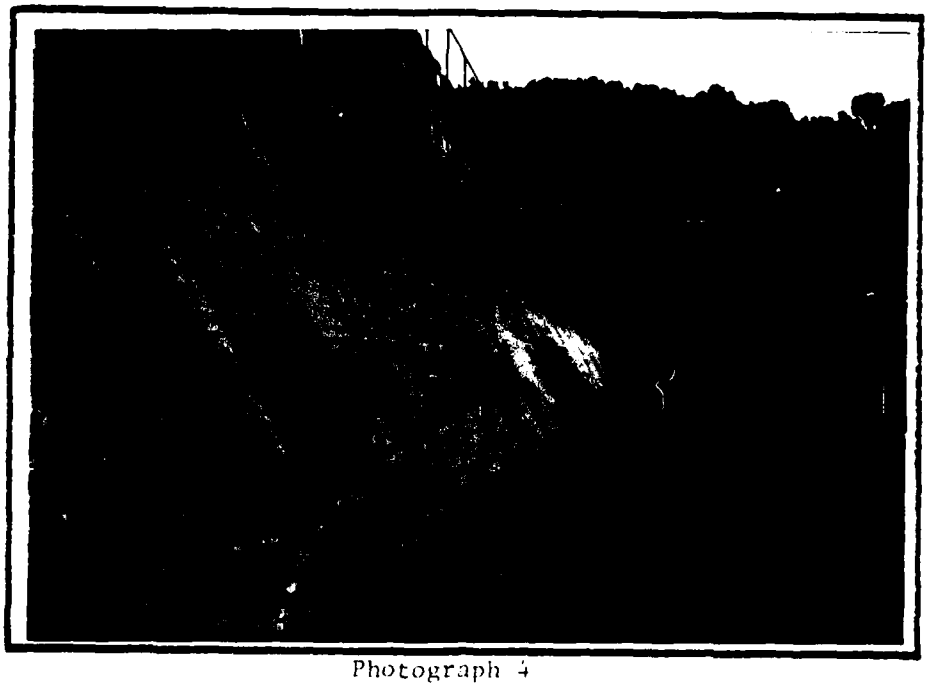
Photograph 2

Downstream slope and crest near left abutment



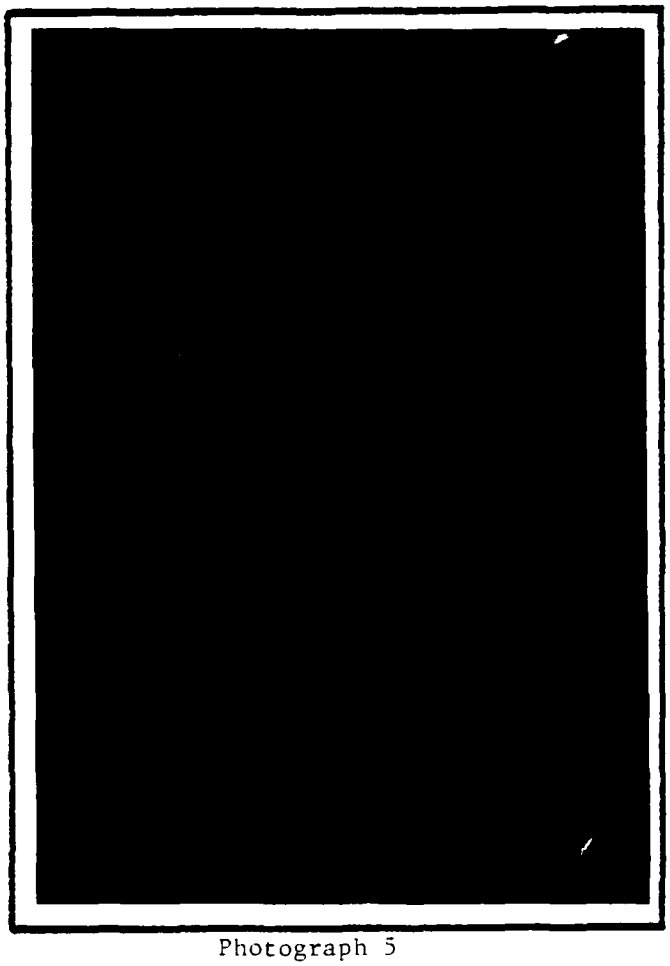
Photograph 3

Downstream slope of dam - Note seepage and deterioration of construction joints



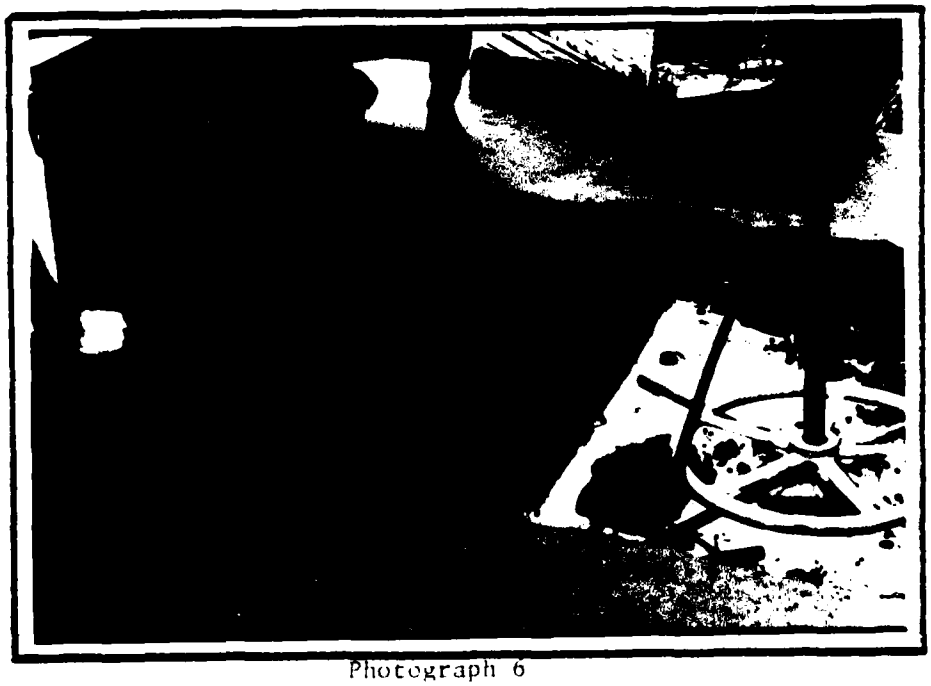
Photograph 4

Downstream slope of dam - Note pump house



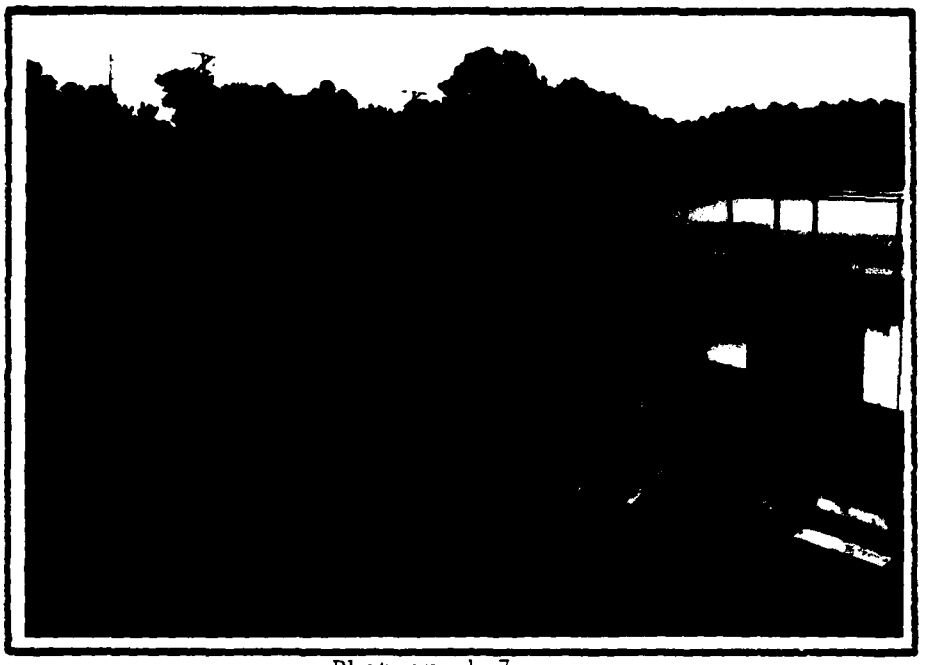
Photograph 5

Deteriorated construction joint



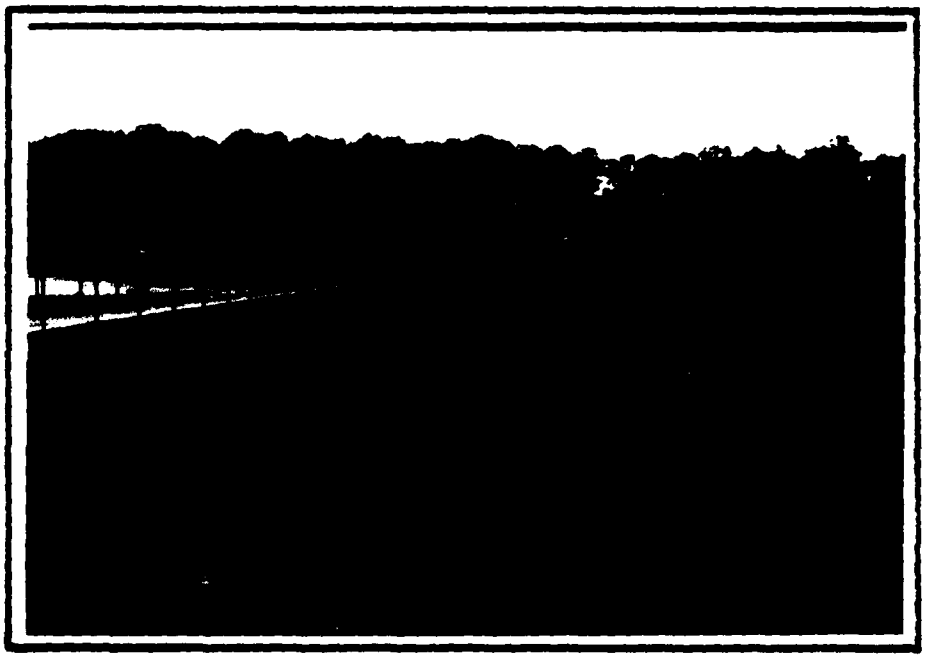
Photograph 6

Intake chamber



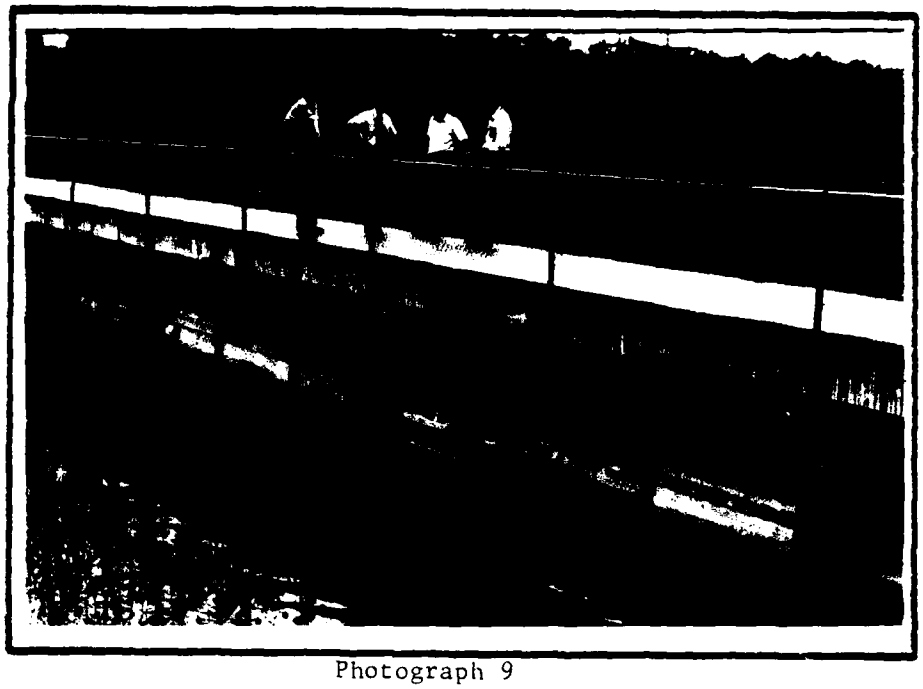
Photograph 7

Spillway - Note flashboards and flashboards which have have been tripped in foreground



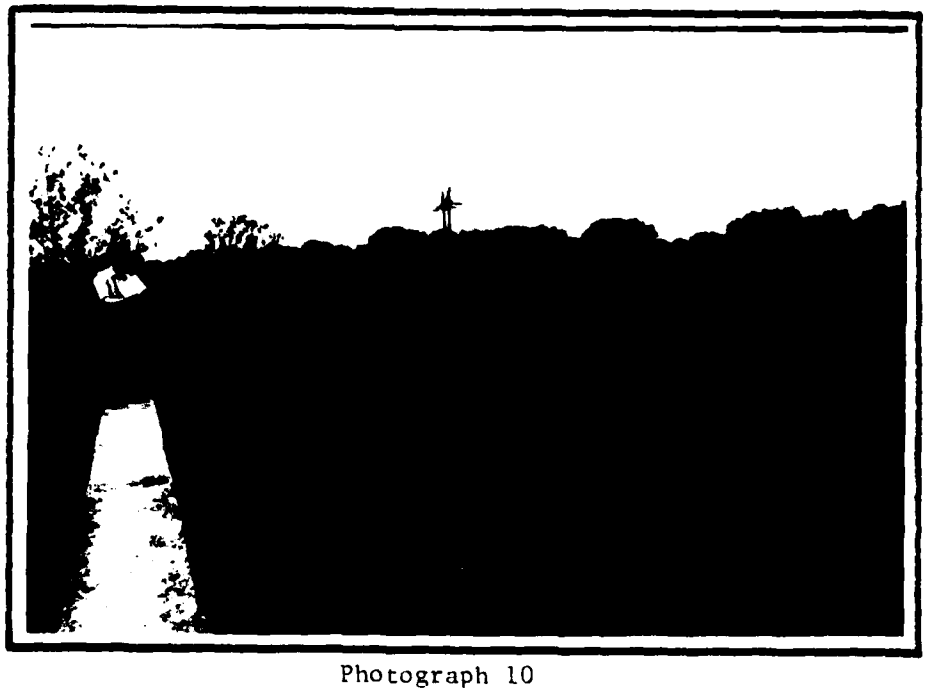
Photograph 8

Spillway and spillway exit channel



Photograph 9

Flashboards in spillway



Photograph 10

Spillway exit channel